

February 14, 2025
PVA EXPO PRAGUE

Guidebook



fykos.org



fyziklani.org



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Fyziklani2025

Dear participants of Fyziklani 2025!

It is my honor to welcome you to the 19th edition of Fyziklani! I am delighted that we are once again gathering in such great numbers – thanks to your participation, Fyziklani continues to strengthen its position as one of the largest international physics competitions for high school students. This year, you have arrived in Prague from more than 10 countries, ensuring that the competition remains not only a challenge but also a place where students from all over the world come together to celebrate physics.

In this booklet, you will find all the essential information about this year's event – both about the competition itself and the rich accompanying program. As always, you can look forward to lectures and a panel discussion with leading Czech scientists, an engaging science show, and excursions to fascinating locations. And because Fyziklani is also about having fun, the program includes a party and a formal banquet.

Fyziklani is constantly evolving, mainly thanks to the organizers who bring new ideas each year to improve and expand the event. This year's preparations once again required countless hours of work, and it is only through this dedication that the competition can take place in its current form. A huge thank you to all the organizers for their efforts.

Great thanks also go to our partners, without whom the competition could not take place on this scale. I must specifically mention CEZ Group, the non-profit FABRIC, the Neuron Foundation, and Qminers, whose support is truly crucial for Fyziklani. Sincere gratitude also goes to all other partners and individuals who support Fyziklani both formally and informally.

But the most important part of Fyziklani is you! I wish you the best of luck in the competition and hope you enjoy Fyziklani to the fullest – whether by solving problems, engaging in discussions with fellow participants, or exploring the beauty of Prague. I truly look forward to the atmosphere we will create together once again. 😊



A handwritten signature in black ink, which appears to read 'David' in a stylized, cursive script.

Vojtěch David
Head organizer of Fyziklani

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Game Schedule

- 08:45 – 09:45 Team Arrival at PVA EXPO**
Presence of Teams before the competition.
Please arrive on time to speed up the process.
- 10:00 – 10:25 Opening Ceremony**
Explanation of the rules and course of competition. Initiation.
- 10:30 – 13:30 Competition**
Participants compete for 3 hours. During the competition, a program is prepared for the accompaniment.
- 14:00 – 14:45 Announcement of Results**
Presentation of valuable prizes for the winning teams and awarding diplomas. The end of the contest.
- 14:45 – 14:50 Joint Photo Shoot of the Winners**
Ceremonial immortalization of the competition winners.

There will also be a lecture for teachers during the competition. More information can be found in the accompanying program section.

Useful Contacts

Name	Role	Phone number
Veronika Hendrychová	Head of the Competition Registration	+420 732 383 025
Lukáš Létal	Accompanying Program	+420 739 833 477
Petr Kahan	Accompanying Program	+420 720 260 115
Simona Švecová	Accommodation	+421 918 751 873
Vojtěch David	Head Organizer of Fyziklani	+420 730 974 923

For problems concerning arrival to the accommodation contact Simona Švecová, in case of delays or problems with travel on the day of the contest, contact Veronika Hendrychová. In case of complications during the accompanying program, please contact Lukáš Létal or Petr Kahan. Only call Vojtěch David when absolutely necessary.

You can also contact us by email at fyziklani@fykos.org.

Accommodation – Hotel Duo

Hotel Duo is a four star hotel. It is located near the metro station Střížkov. Besides 654 rooms, Hotel Duo also offers many high-quality services for leisure time and business affairs. The hotel address is **Teplicka 492, 190 00, Prague, Czech Republic**.

Check-In, Check-Out

You can **check-in from 15:00**. On the departure day, please leave your room, take all your belongings, and **check-out before 10:00**.

Fees and Deposits

Please note that the participants of age 18 years or older will need to pay the city tax of approx. €2 (50 CZK) per night at the arrival to the hotel. All participants under the age of 18 will pay a refundable deposit of approx. €30 (750 CZK) on check-in.

Venues and Maps

PVA EXPO PRAGUE

The competition takes place at PVA EXPO PRAGUE at **Beranových 667, 199 00 Prague 9, Czech Republic**, specifically in the Hall 1. To enter the hall, you must use the (rear/side) Entrance Hall I.

Other Venues

The accompanying program of the competition will take place mainly at the following locations.

Campus Troja

V Holešovičkách 2/747, 180 00 Prague 8

The campus of CUNI MFF, which mostly houses the departments of the physics section. The program will take place in the modern IMPAKT Pavilion (lecture hall **N1**), located on a hill next to the road, and in the T Lecture Rooms (lecture halls **T1** and **T2**), located immediately next to the highest building in the area.

Cross Club

Plynární 1096, 170 00 Prague 7-Holešovice

The venue of the Party after Fyziklani.

Transportation

To get to the **competition venue**, take metro line C (red, goes from the Main Railway Station or the Florenc Bus Station in the Letňany direction) – get off at **Letňany** (terminus). Then walk for about 5 minutes to get to **PVA EXPO building**. **To enter the hall you must approach from the side, see the map.**

From Hotel Duo, you can reach metro station Střížkov within a 5-minute walk. Then, metro line C (red) will get you both to Letňany, and to **Nádraží Holešovice**, from where you can get to **Campus Troja** (V Holešovičkách 2) within a 10-minute walk. Alternatively, you can take the bus 201 from the stops Střížkov or Nádraží Holešovice to the stop Kuchyňka.

For transport to the Party from the Problem Analysis, you can either walk to the venue or take bus number 201 to the Nádraží Holešovice stop.

Recommended Apps

For easy orientation during Fyziklani, you can use Mapy.cz app, which enables users to download map of Prague that works even in offline mode.

Prague has a well-developed public transportation. To search for connections, or to buy tickets with a card, we recommend using the official app PID Lítačka.

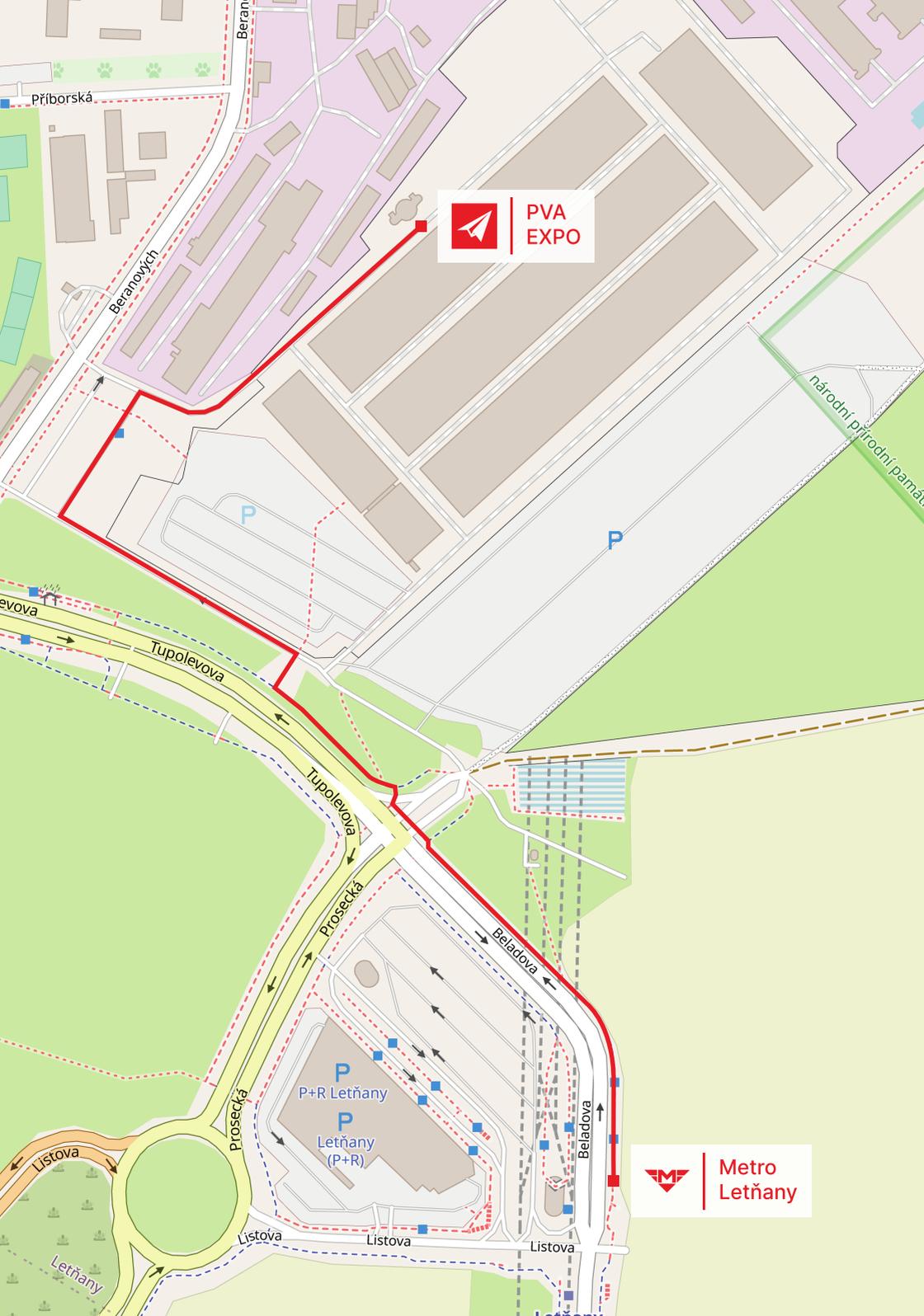
You can download both apps here (works for Android and iOS).

M Mapy.cz app



PID Lítačka app





Příborská

Beran

Beranových



PVA
EXPO

národní přírodní památka

evova

Tupolevova

Tupolevova

Prosecká

Beladova

Beladova

P
P+R Letňany

P
Letňany (P+R)

Listova

Listova

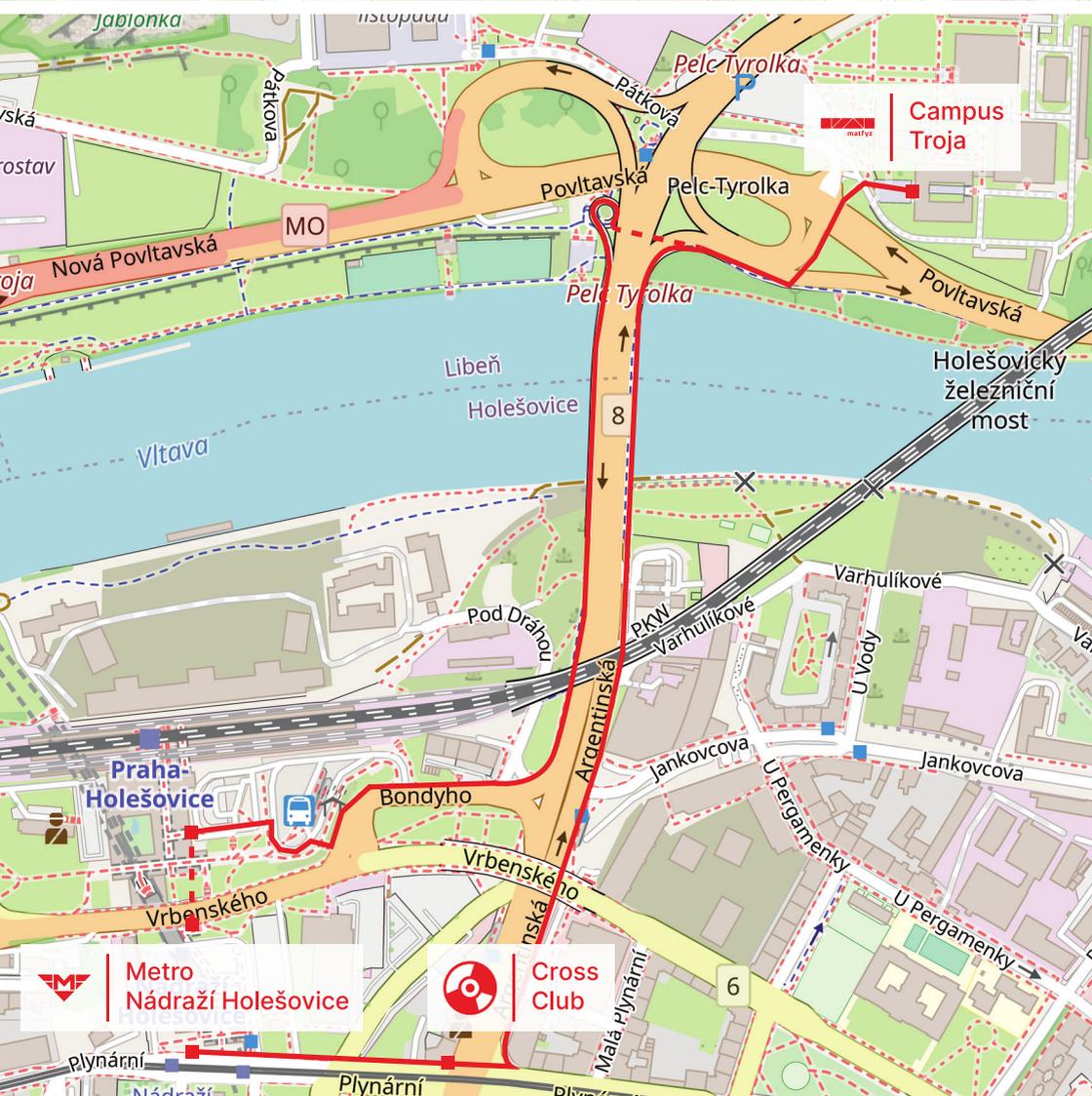
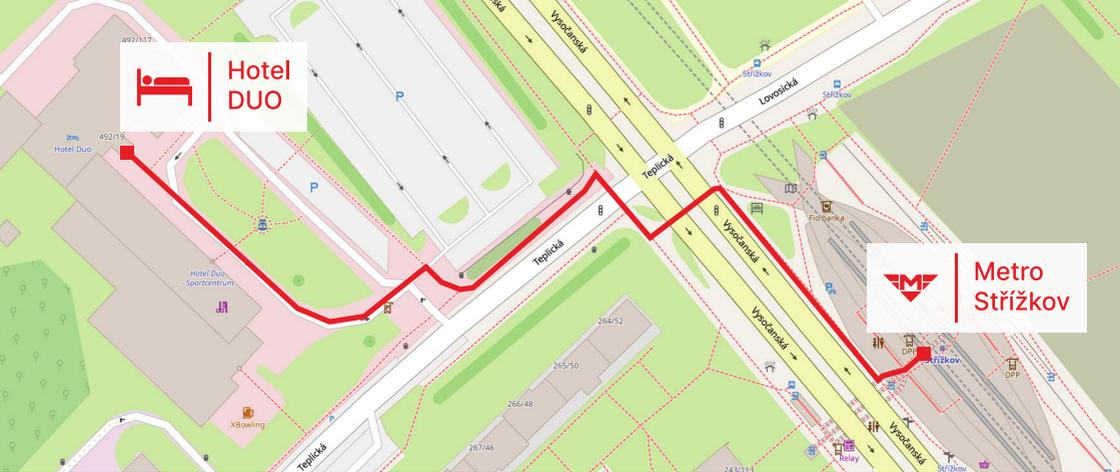
Listova

Listova



Metro
Letňany

Letňany



Accompanying Program

Whole Week

City Rally

An engaging game that will lead you through the streets of Prague while putting your wits to the test.

Wednesday, Feb 12

18:00 – 20:00 **Tour of Stefanik Observatory**

Tour of the observatory with movie screening

Thursday, Feb 13

09:00 – 15:00 **One Day with Physics**

Day full of excursions and lectures at CUNI MFF

19:00 – 21:00 **Panel Discussion with Scientists**

Discussion with scientists about their work in physics

Friday, Feb 14

09:00 – 15:00 **Fyziklani**

The competition itself

17:30 – 19:00 **Problem Analysis**

Presentation and analysis of the solutions to this year's problems from Fyziklani

19:00 – 24:00 **Party**

Meet organizers and the other contestants at an evening party and celebrate Fyziklani.

Saturday, Feb 15

09:30 – 12:00 **Lectures**

Lectures from excellent Czech scientists

14:00 – 16:00 **Science Show**

You may attend the Science Show or try the City Rally.

19:00 – 22:00 **Buffet**

Ceremonial dinner with other contestants and the official closing of the accompanying program

City Rally

The City Rally will take you through Prague. You will form small teams and together solve various tasks related to the streets of the capital city. It is not just an ordinary walk, you will have to engage your mind as well. The end of the game is not fixed, it depends on you.

The City Rally will be open all week at <https://city-rally.fyziklani.org/>; you will receive login details by e-mail. You may look forward to several sets of challenges, so it's up to you whether you choose to explore Prague's viewpoints, islands or, perhaps, go follow a route called Astronomical Prague. The tasks can be found in the game system, where a new question will appear after successfully answering the previous one, until you reach the final destination.

Wednesday

Tour of Stefanik Observatory

Wednesday 18:00 – 20:00

Tour of the observatory at Petřín with an English-language film screening.

For group transportation, please arrive at the Hotel Duo reception no later than 16:45. If you prefer to arrive on your own, be at Štefánik Observatory (Strahovská 205, 118 00 Prague 1) by 17:55.

Thursday

Lab tours – Campus Troja

Thursday 08:45 – 11:30

Please arrive no later than 8:45 a.m. at the Campus Troja to the "T" auditorium.

For more information visit

<https://fyziklani.org/schedule/detail#658>



Afternoon lecture

The lecture will take place at the Campus Troja.

Physics Approach to AI Safety and Adversarial Robustness [EN]

Stanislav Fort – N1

Thursday 13:30 – 15:00

Stanislav Fort is a renowned expert in artificial intelligence, focusing on large language models and AI safety. He has contributed to the development of Claude at Anthropic, worked in teams such as Google Brain and Google DeepMind, and also served as an advisor to the Czech President on AI matters. He will tell us about how to create artificial intelligence that is robust against attacks, and how to use a physicist's way of thinking for research in (safety of) artificial intelligence.

Evening Program

Panel Discussion

Thursday 19:00 – 21:00

During the panel discussion, several top scientists will share their personal experiences to give you an insight into life and work in science. Invitation to the discussion was accepted by

doc. RNDr. Mirko Rokyta, CSc.

He serves as the Dean of the Faculty of Mathematics and Physics at Charles University, a mathematician, and a renowned university educator. Besides his academic career, he is also a keyboard player in the bands Asonance and Humbuk.

RNDr. Tomáš Slanina, Ph.D.

He leads a junior research group at the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, focusing on redox photochemistry.

Mgr. Petr Cígler, Ph.D.

He leads a junior research group at the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, specializing in synthetic nanochemistry.

Ing. Květoslava Stejskalová, CSc.

A science communicator at the J. Heyrovský Institute of Physical Chemistry and a leading expert on Jaroslav Heyrovský himself. She has extensive experience with educational projects such as Nanoškola. Additionally, she is the editor-in-chief of CHEMAGAZÍN, a journal popular among chemists.

doc. Ing. Pavel Jelínek, Ph.D.

He specializes in scanning probe microscopy, through which he reveals new or previously predicted phenomena at the scale of individual atoms and molecules. His calculations confirmed the possibility of chemical contrast in AFM microscopy. He conducts his research at the Institute of Physics of the Czech Academy of Sciences.

The discussion will be hosted by **Bc. Marek Jankola**, a student at CUNI MFF and a long-time organizer of FYKOS, who enjoys thinking about statistical physics or going for a run.

The discussion will take place in the N1 lecture hall in the Troja Campus.

Friday

Problem Analysis

Friday 17:30 – 19:00

Presentation and analysis of the solutions to this year's problems from Fyziklani. It will take place at the Campus Troja in lecture hall **T1**.

Party

Friday 19:00 – 24:00

Come and meet the other competitors and organizers after Fyziklani. The party will take place at **Plynární 1096, 170 00 Prague 7-Holešovice** in **Cross Club**.

For transport from Problem Analysis, you can either walk to the venue or take bus number 201 to the Nádraží Holešovice stop.

Saturday

Lectures

The lectures will take place at the Campus Troja.

First Block

Saturday 09:30 – 10:30

Taming Fibonacci's Rabbits Using Eigenvalues [CS]

doc. Ing. Lubomíra Dvořáková, Ph.D. & Ing. Petr Ambrož, Ph.D. – N1

This lecture is held in Czech.

Science at the Extremes: Generation of High Intensity Laser Pulses and Research at the Extreme Light Infrastructure [EN]

Jonathan Tyler Green, PhD – T1

The Extreme Light Infrastructure (ELI) – Beamlines in Dolní Brezany, Czech Republic is the home of some of the most powerful lasers in the world. It is dedicated to performing research with terawatt and petawatt class lasers, which have peak powers from 1 thousand to 1 million times higher than that generated by a nuclear power plant and are shorter than one millionth of a millionth of a second. Under these extreme conditions, we can generate short X-ray pulses and accelerate protons and electrons to near the speed of light. How do these lasers work and what do they look like? What can we use these accelerated particles and X-rays for? In this talk, we answer these questions and introduce the exciting research happening at this international research center here in the Czech Republic.

Second Block

Saturday 10:50 – 11:50

Theory of Relativity: A Description of Our Space and Time [CS]

prof. RNDr. Pavel Krtouš, Ph.D. – N1

This lecture is held in Czech.

Mysterious Sounds at Jupiter: Juicy Details of Whistlers [EN]

prof. RNDr. Ondřej Santolík, Dr. – T1

Lightning discharges emit electromagnetic pulses, which propagate through the plasma medium as dispersed whistlers. Short duration trans-ionospheric whistlers have been detected for the first time at Jupiter by the Juno spacecraft. They not only constitute the largest existing database of Jovian lightning but they also provide us with inputs for investigation of the ionospheric plasma. Dispersion properties of new propagation modes of whistlers can be explained by peculiar properties of the mode structure and group velocity for extremely

low plasma densities. The radio and plasma waves instrument on the newly launched JUICE interplanetary probe will be able to characterize wave propagation and mode structure of whistler-mode waves.

Science Show

The Science of Light [EN]

Saturday 14:00 – 16:00

Petr Kahan & Soňa Husáková & Kateřina Havelková – N1

Come to a lecture with experiments on the origin of light. Fun and spectacular experiments will guide you from the very birth of light in atoms to the moment a photon reaches our eye.

The science show will take place in lecture hall N1 in the Troja Campus.

Closing Ceremony of the Program

Buffet

Saturday 19:00 – 22:00

After Saturday's scientific program, you will have the opportunity to chat with all the participants who will stay in Prague until Sunday at the buffet. The reception will be held in the IMPAKT Pavilion in the Troja Campus. The buffet will also serve as a closing ceremony for the entire program.

Experience Prague

If you want to experience Prague even more, we encourage you to tour the city and discover its hidden gems either by participating in our City Rally or entirely by yourself. We highly recommend the YouTube channel HONEST GUIDE (see for example <https://www.youtube.com/watch?v=fta6FjsqV2I>) which neatly shows cases what to try (and what to avoid). You may, perhaps, also visit the following museums, each of which is unique in its own way.



National Museum

Václavské náměstí 68, Prague 1

The largest museum in the Czech Republic with 25 expositions mostly related to history of Czech Republic. If you would like to know more about country hosting Fyziklani, you should definitely visit it.

The National Museum houses nearly 14 million items from the areas of natural history, history, arts, music and librarianship, thus offering something for everyone.

<https://www.nm.cz/en>

Visitor Centre of Czech National Bank

Na Příkopě 28, Prague 1

An exciting place in the center of Prague where you can learn something about the Czech currency and the basics of economy. You can also get some free Czech crowns or simply stop inflation by riding a bike.

<https://nc.cnb.cz/pub/en/>

Franz Kafka Museum

Cihelná 2b, Prague 1

The long-term exhibition offers a glimpse into the world of the famous Prague native Franz Kafka, one of the most important figures of 20th century world literature.

<https://kafkamuseum.cz/en/>

The Museum of Decorative Arts in Prague

17. listopadu 2, Prague 1

A museum featuring interesting art-related exhibitions for anyone who wants to relax and ponder after the exhaustive week.

<https://www.upm.cz/en/>

Program for Teachers During the Competition

The program for teachers accompanying the participants will take place at PVA EXPO PRAGUE.

Nuclear Fuel Cycle [CS/EN]

Friday 12:00 – 12:45

Ing. Martin Přeček, Ph.D.

This lecture offers an introduction to the realm of scanning probe microscopy, with a focus on scanning tunneling microscopy and atomic force microscopy. Delve into the inner workings of these techniques and explore the unexpected possibilities they present for investigating the properties of molecules.

The lecture will only be held in Czech, the slides, however, will be in English. The remaining program for the teachers is, unfortunately, held entirely in Czech.

Patronage

Besides the main organizers and the partners, several important public figures significantly contributed and offered their patronage to the competition. We would like to thank them here.

The patronage of this year's event was taken over by **RNDr. Miloš Vystrčil**, President of the Senate of the Parliament of the Czech Republic, Czech politician and pedagogue. After graduating in mathematics-physics at the Faculty of Science of Masaryk University, he worked as a teacher at the Otokar Březina Grammar School, where he also served as deputy headmaster. In his rich political history, he served as the Governor of the Vysočina Region and as the Mayor of Telč. He is currently a Senator for District 52 – Jihlava and since 2020 the President of the Senate of the Parliament of the Czech Republic.

The competition is also held under the patronage of **prof. RNDr. Eva Zažímalová, CSc.**, President of the Czech Academy of Sciences (CAS), a renowned biologist, and researcher. After graduating in biochemistry from the Faculty of Science at CUNI, she dedicated her career to research in plant physiology, particularly the study of phytohormones and their impact on plant growth and development. She spent many years at the Institute of Experimental Botany of CAS, where she held leading scientific and managerial positions. Since 2017, she is the President of CAS and focuses on supporting excellent research, fostering international collaboration, and promoting science. She is a member of numerous scientific councils and committees and contributes to shaping the direction of Czech science in both the European and global contexts.



Miloš Vystrčil



Eva Zažímalová

Organizers

Vojtěch David (Head Organizer of Fyziklani)

Studies 1st year of MSc. Mathematical Structures at CUNI MFF and 1st year of MSc. Teacher Education of Chemistry for Upper Secondary Schools.

Michal Červeňák (IT, Management of Fyziklani)

Works at the Academy of Sciences of the Czech Republic.

Martin Vaněk (Head Organizer of FYKOS until 2024, Consultant of Fyziklani)

Studies 2nd year of MSc. Theoretical Physics at CUNI MFF.

Petr Sacher (Deputy Head Organizer of FYKOS, Treasurer)

Studies 2nd year of BSc. Physics at CUNI MFF.

Lukáš Létal (Accompanying Program)

Studies 2nd year of BSc. Physics at CUNI MFF.

Petr Kahan (Accompanying Program)

Studies 3rd year of BSc. Solid State Engineering at FNSPE CTU.

Adam Krška (IT, Typography, TeX)

Studies 3rd year of BSc. IT at FIT VUT.

Veronika Hendrychová (IT, Head of Registration, Consultant of Fyziklani)

Studies 2nd year of MSc. Mathematical Informatics at FNSPE CTU.

Kateřina Rosická (Consultant of Fyziklani, Accommodation)

Studies 1st year of Ph.D. Physics of Plasmas and Ionized Media at CUNI MFF and Institute of Atmospheric Physics CAS.

David Škrob (Head Organizer of FYKOS)

Studies 2nd year of BSc. Physics at CUNI MFF.

Daniel Dupkala (Consultant of Fyziklani)

An IRC Government of Ireland Scholar conducting postgraduate research of exoplanets at Trinity College Dublin.

Soňa Husáková (Graphic Designer)

Works at ÚDiF Physics Theatre.

Tomáš Červeň (Graphic Designer)

Studies 3rd year of MSc. Physics at CUNI MFF.

Patrik Stercz (Problem Selection Supervisor)
Studies 1st year of BSc. Physics at CUNI MFF.

Monika Drexlerová (Partners of Fyziklani)
Studies 1st year of BSc. Physics at CUNI MFF.

Elena Chochořaková (Consultant of Fyziklani, HR)
Studies 3rd year of BSc. Physics at CUNI MFF.

Radomír Mielec (Consultant of Fyziklani, Communication with Participants)
Studies 3rd year of BSc. Physics at CUNI MFF.

Jakub Dřevo (Marketing, PR)
Studies 3rd year of BSc. Physics at CUNI MFF.

Tereza Hochmanová (PR, Socials)
Studies 2nd year of BSc. Physics at CUNI MFF.

Amálie Anna Kulháňková (PR, Socials)
Studies 1st year of BSc. Nuclear and Particle Physics at FNSPE CTU.

Simona Švecová (Accompanying Program)
Studies 2nd year of BSc. Dental hygiene at PU Prešov.

Luboš Veverka (Operational Support for Fyziklani)
Manages the Department of Promotion and Media Communication at CUNI MFF.

Anna Kotěšovcová (Operational Support for Fyziklani)
Works at the Department of Promotion and Media Communication at CUNI MFF.

Michaela Němcová (Operational Support for Fyziklani)
Works at the Department of Promotion and Media Communication at CUNI MFF.

Participated in the preparation of problems, reviews, and translations:

Jan Benda, Prokop Bernard, Dávid Brodňanský, Anežka Čechová, Vojtěch David, Monika Drexlerová, Daniel Gros, Veronika Hendrychová, Jaroslav Herman, Tereza Hochmanová, Ivan Hudák, Elena Chochořaková, Marek Jankola, Juraj Jánošík, Jindřich Jelínek, Jakub Kliment, Dominik Klimsza, Karel Kolář, Adéla Kolibusová, Jakub Koňárek, Adam Krška, Radka Křížová, Radek Kuklík, Radovan Lev, Lukáš Létal, Klára Matějková, Radomír Mielec, Šimon Pajger, Kateřina Rosická, Petr Sacher, Maxmilián Ladislav Skuda, Patrik Stercz, Jakub Šafin, David Ševčík, David Škrob, Josef Trojan, Tomáš Tuleja, Martin Vaněk, Tereza Voltrová

FYKOS

Fyziklani is organized by FYKOS – a group with the aim of inspiring and educating high-school students in physics and related fields. FYKOS is under the patronage of CUNI MFF and has a rich 38-year history of organizing educational events.

The keystone activity of FYKOS is a correspondence competition of the same name. It is open to all high-school students with an interest in physics. We publish eight new problems six times a year. Participants have about a month to solve these problems and submit their solutions, which we mark and send back with comments and helpful feedback.

The best contestants of FYKOS can attend week-long camps in spring and fall focused on physics education, including lectures or experiments, but also offer plenty of engaging games and leisure activities. Along with Fyziklani, FYKOS organizes an online version of the competition – Physics Brawl Online, which is held every year in late November – and also many other events, such as the Day with Experimental Physics.

You can learn more about the activities of FYKOS and how to take part in them at <https://fykos.org>.



FYKOS

Faculty of Mathematics and Physics, Charles University

FYKOS and Fyziklani 2025 are under the auspices of the Faculty of Mathematics and Physics at Charles University (CUNI MFF). You can find more information at <https://mff.cuni.cz/en/>.

The Charles University is the oldest university in Central and Eastern Europe and it is the best-ranked university in said region (e.g. in the Academic Ranking of World Universities). It was founded in the year 1348 by Charles IV. The CUNI MFF was founded in 1952.



The Ministry of Education, Youth and Sports of the Czech Republic

The Ministry of Education, Youth and Sports of the Czech Republic (MEYS) annually lists Fyziklani among the official competitions maintained by MEYS.

MEYS is responsible for public administration in education, for developing educational, youth and sport policies and international cooperation in these fields.



General Partner

CEZ Group

Although CEZ Group is based in the Czech Republic, its energy activities span across multiple European countries, making it one of the largest energy companies in Europe.

We lead by example, driving innovations and implementing modern technologies to transform the energy sector into a more sustainable, environmentally friendly, and socially responsible industry. One of CEZ's key strategic priorities is to achieve climate neutrality by 2040.

We are passionate about energy and love to share its magic with others. That's why we support and organize various events for high school and university students with a passion for technical fields—because physics is at the core of how all our power plants and distribution networks operate.

We wish all participants of Fyziklani 2025 an unforgettable experience and the best of luck in the competition.

If you'd like to join one of our initiatives, check <https://kdejinde.jobs.cz/studenti-a-absolventi>. And for those eager to dive deeper into the fascinating world of energy, visit our website www.svetenergie.cz.



kdejinde.cz



svetenergie.cz



Support of Fyziklani

FABRIC

FABRIC is a non-profit that organizes several events for students with analytical thinking who want to understand themselves and the world. One of these is the ESPR (European Summer Program on Rationality), an engaging and intensive workshop for mathematically gifted students. ESPR aims to help participants acquire rigorous quantitative, as well as other practical skills and techniques useful in many areas of life – from game theory and mathematical logic, through communication skills and the basics of rational thinking to cognitive science. ESPR is largely about improving thinking and reasoning, and its reflection in better practical decisions, whether for individuals or for society. After the camp ends, ESPR instructors further help their participants to develop or start and build their own projects, organize various meetings, etc.

FABRIC

The program usually takes place in the summer in England and is free for participants (with the possibility of reimbursement for travel and other expenses). Besides ESPR, the same group also co-organizes WARP, the winter version of this workshop, ASPR, a similar camp held in Asia, or PAIR (Program on AI and Reasoning), which also focuses more on the functioning and implications of artificial intelligence.

For more information, visit <https://fabric.camp>.

Platinum Partners

Neuron Foundation

“Passionate teachers often ignite a love for science in young students. They guide them toward Olympiads and knowledge competitions, where they can fully develop their talent and enthusiasm for discovery. Many laureates of the prestigious Neuron Prize, which we award to outstanding scientists, as well as our patrons, confirm this. Success in a high school Olympiad is often the first spark that leads to a successful scientific career.



We wish all high school students who enjoy physics to keep their enthusiasm, passion, and excitement for as long as possible. We look forward to the day

when a Neuron Prize laureate in physics tells us about their success in Europe’s largest physics competition!” – Monika Řasa Vondráková, Co-founder and Director of the Neuron Foundation.

The Neuron Foundation is dedicated to popularizing Czech science and inspiring talented students to pursue scientific careers. It helps them navigate the world of science, fulfill their scientific aspirations, and supports their internships at prestigious foreign universities and research institutions. Neuron has long supported organizations that introduce students to the world of science and create new opportunities for them.

Qminers

 Qminers is a Czech technology company specializing in algorithmic trading software. Our autonomous trading algorithms operate in financial markets worldwide, utilizing advanced mathematical models and data analysis. Since our founding in 2012, Qminers has been continuously growing-driven by a rigorous scientific approach and an exceptional team of experts.

Our team consists of top specialists from various fields—including probability, mathematical statistics, cybernetics, and software engineering. We thrive on intelligence, diversity, and collaboration, which not only fuel our business success but also push the boundaries of innovation. We enjoy solving problems no one has solved before and continuously expanding what is possible.

At Qminers, we take a responsible approach. We avoid “toxic” financial products such as cryptocurrency trading and focus on projects that bring real societal benefits. Through our foundation, we support education every year—for example, through the Matika Česku initiative—because we believe that investing in education is investing in the future.

We support events like Fyziklani because we know that passion, dedication, and ambition are born where young people are given the opportunity to develop their talents.

Find out more about us at <https://qminers.com/>.

Silver Partners

Kalabria

Kalabria company was founded in 1911 and made its breakthrough by producing Calabria lemon juice from lemons imported from the Calabria region in South Italy – hence the name. Nowadays, it produces several kinds of soft drinks and syrups in typical local flavors – in some cases innovated for the 21st century. The authentic taste of their craft soda is guaranteed by the use of the highest quality ingredients and experienced manufacturing processes.



**KARÁSKOVY
LIMONÁDY
A SIRUPY**

Kalabria company supported Fyziklani by gifting 2000 bottles of Karáskova limonáda, which were given to participants to stay hydrated.

FAST ČR | Casio

Casio is one of the leading manufacturers of calculators, which are an essential tool for learning mathematics and physics in schools worldwide. Thanks to a combination of innovation, reliability, and practical design, Casio calculators support effective education for students of all levels.

CASIO.

From basic models for elementary schools to advanced scientific and graphing calculators, Casio offers solutions for every need. Key advantages include intuitive interfaces, long lifespan, support for complex calculations, and an eco-friendly design.

Casio is a symbol of quality and a trusted partner in education, making even the most challenging scientific concepts easier to understand.

The company has donated 15 scientific and 5 graphing calculators for the competition winners.

ELKAN | Wolfram Research



WOLFRAM

ELKAN, spol. s r.o. is a Czech company that has been the exclusive distributor of Wolfram Research products for the Czech and Slovak Republics for over 30 years. It specializes in deploying the **Mathematica** software tool for solving complex problems across various fields, spanning both industrial and academic sectors.

The company provides expert consulting, implementation support, and educational activities focused on machine learning, image processing, and the application of advanced mathematical methods.

Partners

Humusoft | MathWorks



Humusoft s.r.o. is a Czech company that since its foundation has divided its efforts equally between the production and sale of instrumentation and software. It is the exclusive representative of the American company MathWorks, Inc. for the Czech Republic and Slovakia. HUMUSOFT s.r.o. also participates in the development of MATLAB® / Simulink® system superstructures. They provided 10 MATLAB® & SIMULINK® Student Suite licenses and other donations for the competition.

Hobžovy Strážnické brambůrky (Hobža's crisps)



"We are not chips, we are crisps, crisps from Moravia!" – family company taking pride in quality and taste, making sure the crisps really taste the way they should. Hobža's brothers gave us 30 boxes of crisps, and they believe they will come in handy during the competition.

Escape Point



"Intelligent entertainment" – an escape game that makes you think. Escape point provides eight unique games with adjustable difficulty, but beware, the clock is ticking. They donated 5 vouchers for a game of one's choice for the best teams.

Prometheus

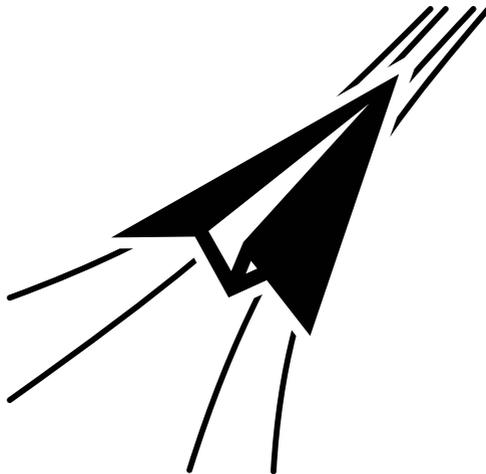
Prometheus, spol. s r. o. publishes textbooks, collections, and other literature dealing with physics and mathematics. Their physics tables are known to everyone in the Czech Republic. Most of the books are intended for primary and secondary school students and their teachers, but they also offer titles dealing with history and important people contributing to mathematics and physics.



Prometheus has supplied book prizes for the winners.

Czech Association for Effective Altruism

Effective Altruism is a philosophy and global movement that aims to use a rational approach and scientific methods to determine how and where we can have the greatest positive impact and then translate these findings into practice. More information and how to get involved can be found at <https://www.effectivealtruism.org>. The association donated popular science books for the winners.



Brief Rules

- Fyziklani is a three-hour-long team competition taking place in Prague, Czech Republic.
- The competition is held for teams of up to 5 high-school students, who attend two different high schools at most.
- At any instance, every team should have 7 tasks accessible. Solutions of the tasks should be written on the paper that states the problem and delivered to the judges. In the case of a correct solution, the team earns points and gets a new task straight away. In case of an incorrect solution, the team gets the task back to correct their answer.
- Every problem solved on the first try is awarded 5 points, on the second try with 3 points, on the third try with 2 points and with 1 point otherwise.
- The only way to get a new problem is to solve another one correctly; you can't skip problems. In an exceptional case the judge can ask how the team found the solution.
- Solutions are accepted in standard form, i. e., with correct units. Fractions should be simplified. You should use constants like π and round the numbers correctly.
- It is allowed to use any written or printed materials. Electronic gadgets are strictly forbidden (except for calculators).

Full Rules of Fyziklani

Participation in the Competition

- To participate in the competition, pre-registration is required at <https://fyziklani.org/>.
- By registering for the competition, each team agrees to follow the Rules of Conduct and these Rules of Fyziklani and confirms they have made themselves acquainted with them.
- A team consists of 1–5 competitors.
- All team members must be high-school students, primary school students, or their respective equivalents.
- A team must consist of competitors belonging to at most two schools.

- Students of a single school can compete at most in four distinct teams. In the case of unfilled places or other similar conditions, the organizers reserve the right to make an exception to this rule.
- The name of a team cannot spread political or religious views, cannot be insulting, or be in any other way inappropriate. The head organizer has a right to change the name of such a team, censor it, or disqualify the team completely.
- By registering in the competition, the team members agree with publishing the results of their team in the form of basic information (your name, surname, category, school, and points) in the results list in both print and digital outputs.

Designation into Categories

- Teams compete in three categories; to which they are placed based on the following algorithm.
- Each contestant is assigned a coefficient based on the expected year of high school graduation. A contestant who is in the final, i.e., graduating, year of secondary education at the time of the competition (specifically, a school corresponding to level 3 of the ISCED 2011 classification) is assigned a coefficient of 4. A contestant in the penultimate year is assigned a coefficient of 3, and so on. The lowest possible coefficient is 0 (this is assigned to pupils of primary schools and the corresponding years of multi-year grammar schools).
- The coefficient of a team is calculated as the arithmetic mean of the coefficients of individual competitors (they are added together and divided by the number of competitors).
- The team is assigned the lowest category whose conditions it satisfies:
 - category A: team coefficient ≤ 4 ,
 - category B: team coefficient ≤ 3 and maximum of two competitors have a coefficient of 4,
 - category C: team coefficient ≤ 2 , no member has a coefficient 4, and a maximum of two competitors have a coefficient of 3.
- A team can compete in category A even if its coefficient places it into a lower category if it chooses to do so during the registration.
- Organizers reserve the right to move a team back to the lower category, or conversely move a team to category A if the need arises. The team will be notified of such a change at least one day before the competition.

- All categories share the same set of problems.
- Each category of the competition has a separate results list.

Arrival to the Competition

- Teams are required to arrive on time. Organizers reserve the right not to admit late-arriving teams to the competition.
- Teams are required to present themselves upon arrival and provide accurate information about their members (years, schools, etc.). Teams are obliged to point out any changes in their composition.
- Each team will receive an envelope with the first seven tasks. It is forbidden to open this envelope until the head organizer or an organizer designated by him has given clear instructions to do so.

The Competition System and Awarding of Points

- The competition lasts 3 hours.
- At the beginning of the competition, each team receives 7 problems, which they try to solve.
- If the team thinks it has arrived at the correct solution to a problem, it sends one of the competitors to one of the examiners, who tells the member whether that solution is correct or incorrect. The designated member must present the paper with the problem with a solution clearly marked on the paper.
- The examiners may request a team to describe the steps used to solve the problem.
- The presenting member selects the correct examiner based on the label on the problem sheet. The proper selection algorithm will be explained before the start of the competition.
- If the solution is incorrect, the examiner marks this on the problem sheet, and the presenting member returns to the team and continues solving this problem.
- If the solution is correct, the examiner marks the problem sheet with the number of points obtained and forwards the presenting member to the distributor, from whom the presenting member receives a new problem sheet.

- The problems are awarded points based on the attempts needed to solve them in the following way: a single attempt – 5 points, two attempts – 3 points, three attempts – 2 points, and four or more attempts – 1 point.
- The team aims to receive as many points as possible.
- During the competition, the up-to-date results of all teams are posted. However, these will be hidden 20 minutes before the end of the competition.
- If a serious issue is discovered with a competition problem, organizers reserve the right to modify or eliminate it without compensation.
- During the competition, all competitors are allowed to communicate only with their team members or the organizers. Any interaction with teachers, other teams, etc. is strictly forbidden.
- Teams are permitted to use any literature in printed, paper form. It is forbidden to use the Internet during the competition. Furthermore, teams are permitted to use calculators and writing or drafting supplies. The calculator must not allow access to the Internet or any other form of communication (devices like mobile phones, tablets, laptops, smartwatches, and similar are strictly prohibited from being used as calculators).
- All supplies that the competitors use or have in their surroundings during the competition, can be requested to be disclosed to the organizers for control.

Conclusion of the Competition and Announcement of Winners

- The end of the competition is clearly announced by the head organizer or an organizer designated by him.
- After the announcement of the end of the competition, no team is allowed to send a member to the examiners. If a presenting member was standing in a queue to an examiner when the end was announced, the member is allowed to stay there and their solution will be examined, but they are forbidden to use any writing supplies.
- In case the number of points obtained by teams is not sufficient to determine the winners or any other awarded positions, the order will be decided based on several criteria in the following order: higher average points awarded per submitted problem, a higher number of problems awarded 5 points, a higher number of problems awarded 3 points, a lower team coefficient, earlier date and time of team registration and a random draw.

Breach of Rules

- In the case of a substantial suspicion of a breach of the Competition Rules or the Rules of Conduct, the head organizer has a right to perform special measures to confirm or rebut the suspicion and to prevent the continuation of disallowed conduct.
- If a team violates any of the Competition Rules or Rules of Conduct, the head organizer or a designated committee will determine the appropriate consequences for the team.
- In the case of a less serious breach of rules, the head organizer or a committee designated for this task by the head organizer can decide on the removal of a certain number of points from a team based on the severity of the breach.
- Organizers are allowed to disqualify a team that commits a severe breach of rules.
- In the case of an extremely severe breach of the Competition Rules or the Rules of Conduct, the Central Committee of the competition may decide to ban participation in the competition in the subsequent years or another punishment, to the competitors of the team and/or to any of the schools they come from. The organizer also reserves the right to share information about rule violations with the organizers of other competitions and activities organized or promoted by the CUNI MFF and with representatives of the competitors' schools.
- Extremely severe breaches of rules involve any intentional attempt to obtain the problems or their solutions before the competition, their publication, or disclosure to anybody outside their team. Any intentional attempts to impede the smooth running of the competition to the other participants or the organizers, or an attack on the competition server are also understood as extremely severe breaches of rules.

Final Remarks

- Organizers reserve the right to make minor changes in the rules before the start of the competition.
- Resolution of any potential conflicts or issues not covered by these rules is decided by the head organizer or an organizer designated by him. The team will be informed of these decisions at the email addresses provided in the application form.

- If a team disagrees with a decision made by the head organizer, they have the right to appeal within 14 days of the decision being made. The Central Committee of the competition will process the appeal and decide within 40 days of the appeal being submitted.
- These rules were ratified by the Central Committee of the competition Fyziklani on September 19, 2023.
- These rules replace the previous version and come into effect on September 19, 2023.

You can find full Organizational Regulations of Fyziklani at:
<https://fyziklani.org/rules/organizational-regulations>.



Fyziklani2025

List of Constants

Fundamental Physics Constants

speed of light in vacuum	c	$2.998 \cdot 10^8 \text{ m}\cdot\text{s}^{-1}$
permittivity of free space	ε_0	$8.854 \cdot 10^{-12} \text{ F}\cdot\text{m}^{-1}$
permeability of free space	μ_0	$1.257 \cdot 10^{-6} \text{ H}\cdot\text{m}^{-1}$
gravitational constant	G	$6.674 \cdot 10^{-11} \text{ m}^3\cdot\text{kg}^{-1}\cdot\text{s}^{-2}$
Planck constant	h	$6.626 \cdot 10^{-34} \text{ J}\cdot\text{s}$
reduced Planck constant	\hbar	$1.055 \cdot 10^{-34} \text{ J}\cdot\text{s}$
elementary charge	e	$1.602 \cdot 10^{-19} \text{ C}$
electron mass	m_e	$9.109 \cdot 10^{-31} \text{ kg}$
proton mass	m_p	$1.673 \cdot 10^{-27} \text{ kg}$
atomic mass unit	u	$1.661 \cdot 10^{-27} \text{ kg}$
Avogadro constant	N_A	$6.022 \cdot 10^{23} \text{ mol}^{-1}$
Boltzmann constant	k_B	$1.381 \cdot 10^{-23} \text{ J}\cdot\text{K}^{-1}$
molar gas constant	R	$8.314 \text{ J}\cdot\text{mol}^{-1}\cdot\text{K}^{-1}$
Stefan-Boltzmann constant	σ	$5.670 \cdot 10^{-8} \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-4}$

Astronomical Constants

mass of Earth	M_{\oplus}	$5.974 \cdot 10^{24} \text{ kg}$
mass of Sun	M_{\odot}	$1.989 \cdot 10^{30} \text{ kg}$
equatorial radius of Earth	R_{\oplus}	$6.378 \cdot 10^6 \text{ m}$
equatorial radius of Sun	R_{\odot}	$6.957 \cdot 10^8 \text{ m}$
astronomical unit	au	$149.6 \cdot 10^9 \text{ m}$

Other Useful Constants

gravity of Earth	g	$9.81 \text{ m}\cdot\text{s}^{-2}$
normal pressure	p_a	101.325 kPa
normal temperature	t	$20 \text{ }^\circ\text{C}$
air density ¹	ρ	$1.20 \text{ kg}\cdot\text{m}^{-3}$
molar mass of air	M_{air}	$28.96 \text{ g}\cdot\text{mol}^{-1}$
speed of sound in air ¹	c_s	$343 \text{ m}\cdot\text{s}^{-1}$
Zero-point of Celsius scale	$0 \text{ }^\circ\text{C}$	273.15 K
density of mercury ¹	ρ_{Hg}	$13500 \text{ kg}\cdot\text{m}^{-3}$
heat capacity of mercury ¹	c_{Hg}	$140 \text{ J}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$

Properties of Water¹

specific latent heat of vaporization	l_v	$2.26 \cdot 10^6 \text{ J}\cdot\text{kg}^{-1}$
specific latent heat of fusion	l_t	$3.34 \cdot 10^5 \text{ J}\cdot\text{kg}^{-1}$
heat capacity	c	$4184 \text{ J}\cdot\text{kg}^{-1}\cdot\text{K}^{-1}$
molar mass	$M_{\text{H}_2\text{O}}$	$18.02 \text{ g}\cdot\text{mol}^{-1}$
index of refraction	n	1.333
density	ρ	$998 \text{ kg}\cdot\text{m}^{-3}$
dynamic viscosity	μ	$1.005 \cdot 10^{-3} \text{ Pa}\cdot\text{s}$
surface tension	σ	$7.27 \cdot 10^{-2} \text{ N}\cdot\text{m}^{-1}$

¹Under normal conditions.

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