A Year of IMAGINATION

Presented in Partnership with Caltech
As a gesture of gratitude to the city that would have hosted our in-person 2022 Science Olympiad National Tournament, Science Olympiad and Caltech are partnering with STEAM:CODERS to raise funds for this Los Angeles-area nonprofit that teaches logic, critical thinking and problem solving to underserved students. From April 10 to May 14, 2022, Science Olympiad teams, coaches, parents, officials, sponsors and volunteers are invited to donate any amount. A goal of $10,000 has been set, and a generous $10,000 matching donation has been secured! Let’s show our Science Olympiad spirit to those in need. It's Good to Be Smart, and Smart to Be Good! Donations can be made at: https://steam-coders.networkforgood.com/projects/155119-science-olympiad-caltech
On behalf of the Science Olympiad Executive Board and Advisory Committee, our staff, State Directors and Supervisors, I’d like to welcome you to the 38th Annual Science Olympiad National Tournament presented in partnership with Caltech, a world-renowned science and engineering institute.

The theme of this year’s Science Olympiad National Tournament is Imagination, which perfectly captures the spirit of invention and creativity in Caltech’s home state of California. From advances at NASA’s Jet Propulsion Laboratory to Nobel Prize-winning research at Caltech to dazzling entertainment streaming out of Hollywood, imagination is in the air.

That same spirit of imagination infused this year’s tournament season, informing the designs of your bridges, vehicles, planes and devices and driving your thirst for knowledge and understanding of the scientific world. I know that solutions for many of the problems we face – from eradicating disease, to providing clean energy, to feeding the hungry – will be solved by Science Olympiad alums, and many of you reading this today.

I know we’re not supposed to play favorites, but I think our Science Olympiad students represent the best of the best. Not only are our participants academically talented, but they also bring the 3C’s of Science Olympiad to life, exemplifying character and citizenship in the community by founding charities, starting mentoring programs and performing college-level medical research. The positivity and commitment to serving others gives me great hope for this next generation of leaders and STEM stars.

While this year was another one for the books – testing our resolve, our resilience and our spirit – together, we made it work, and here we are, at the apex, the 2022 Science Olympiad National Tournament! Now it’s time to show the world what it means to be a champion. Best of luck to all!

Jenny Kopach  
CEO  
Science Olympiad
May 13, 2022

Dear Participants:

Welcome to Caltech, and congratulations on qualifying for the 2022 Science Olympiad National Tournament. It is an honor to host some of the world’s most talented and enthusiastic students and watch you navigate this week’s challenging events.

Every day, we see the importance of science and engineering in revealing the mysteries of the universe and in improving people’s lives. Pressing challenges from clean energy to global health to climate change depend on translating our understanding of the fundamental science into innovative new technologies.

At the heart of these achievements is the love of discovery, from illuminating the realm of subatomic particles to detecting colliding black holes. Only with imagination can we develop the new ideas that have the potential to change the world.

Since its founding, Caltech has welcomed and sought the most imaginative thinkers. The Institute has nurtured leading scholars, giving rise to accomplishments such as the detection of gravitational waves, the directed evolution of enzymes, the mitigation of air pollution, and the analysis of chemical reactions within quadrillionths of a second. Caltech scholars are responsible for the creation of the Jet Propulsion Laboratory (JPL), which successfully launched America’s first satellite, landed the first spacecraft on Mars, and flew the first helicopter on another planet. Collectively, Caltech scholars have earned 46 Nobel Prizes, 17 Wolf Prizes, and 42 MacArthur “Genius” Awards, to name a few.

As you embark on your journey, may you find inspiration from your time here on the Caltech campus. Your scientific imaginations will change the world for the better. We thank you for enriching our community with your energy, curiosity, and big ideas.

Enjoy the tournament!

Sincerely,

Thomas F. Rosenbaum
Welcome to the 2022 Science Olympiad National Tournament, hosted jointly by Caltech and Southern California Science Olympiad. The team here could not be more excited to invite you virtually to our home in Pasadena, CA. Located just beyond the sunny beaches and the glamour and glow of Hollywood, Caltech has been the home of imagination for more than a century. At the forefront of science, technology, engineering, and math, Caltech has earned the most Nobel prizes per capita, and continues to produce world-class research through the hard work of its 3,000 students, staff, and faculty.

The fundamental questions you all encounter in your various events are no different than those that we at Caltech seek to answer every day. It is therefore fitting that Caltech plays an essential role in Science Olympiad, running various Southern California Regional tournaments, hosting the Southern California State Tournament since 2006, and now, for the first time, hosting the National Tournament.

As with any major effort, the 2022 Science Olympiad National Tournament is only possible through the hard work of hundreds of volunteers from Caltech and our partner universities, as well as alumni throughout Southern California and across the nation. Everything from exam questions to video production to merchandise was the result of the amazing team we’ve built over the years. This tournament serves as a testament to their character and collaborative spirit, just a couple of Caltech’s defining qualities.

Closer to home, the Caltech administration and staff, the Scilympiad team, as well as our generous sponsors have supported us for many years as we strove to bring Science Olympiad to students of all backgrounds. We would also like to acknowledge the time that the coaches and parents put in to get the students to where they are today.

Regardless of your outcome at this year’s Nationals, know that you all are leaders in science. Just participating in Science Olympiad is a symbol of your dedication and perseverance. It ensures that you, as part of the next generation of scientists and leaders, will have the foundation needed to tackle the challenges of tomorrow. From all of us at Caltech and Southern California Science Olympiad, congratulations on your success and good luck at the upcoming competition! We hope our tournament invigorates your love for science and inspires you to join us in pushing the boundaries of knowledge.

Peter, Jolly, and Albert
Co-Directors of the National Tournament
2022 SCIENCE OLYMPIAD

May 13, 2022

Dear Friends:

It is my great pleasure to welcome you to the 2022 National Science Olympiad National Tournament.

For well over three decades, the Science Olympiad, a remarkable science, technology, engineering and math (STEM) organization, has been a positive influence and inspiration to hundreds of thousands of students across the entire nation to study and pursue careers in a STEM field. This year, Science Olympiad’s national tournament will be co-hosted by the world-renowned California Institute of Technology (Caltech) and the theme, Imagination, perfectly encapsulates the incomparable creativity and ingenuity found on the campus of Caltech.

In this globalized and digital age, STEM education and a STEM-trained workforce are needed more than ever, and to that end, I commend Caltech and Science Olympiad for fostering and providing outstanding opportunity to our nation’s STEM students with the 2022 national tournament.

My best wishes to all for a successful tournament!

Sincerely,

ADAM B. SCHIFF
Member of Congress
California’s 28th District
May 13, 2022

Caltech
Pasadena, CA 91125

Dear National Science Olympiad participants,

It is with great pleasure that I welcome you on behalf of California’s 27th Congressional District to the 38th Annual Science Olympiad National Tournament proudly hosted by Science Olympiad and Caltech.

The COVID-19 pandemic highlighted the increasing importance of a STEM education. During a time when we were forced to physically distance from one another, technology kept us all connected through virtual meetings, social media, and other vital platforms. As we make our way out of the pandemic, there remain many problems that face our world and STEM gives us the tools to tackle monumental challenges like climate change, infectious diseases, income inequalities and much more. A STEM education is now more important than ever, and the powerful skills our youth gain in these fields will ensure that our nation remains at the forefront of progress and technological advancements.

The Science Olympiad National Tournament represents the highest level of achievement for the country’s best Science Olympiad teams. I also want to welcome the Global Ambassador Team from Japan, representing more than 2,000 students. I applaud you all on your advanced skill and devotion to scientific achievement and innovation, as well as how we can all become responsible global citizens.

On behalf of the United States House of Representatives and the people of the 27th Congressional District, I offer my congratulations and best wishes for the success of your research and future endeavors.

Sincerely,

JUDY CHU, Ph.D.
Member of Congress, 27th District
WELCOME from
MAYOR VICTOR GORDO

OFFICE OF THE MAYOR

May 13, 2022

Dear Friends and Supporters
of the Science Olympiad National Tournament:

On behalf of the City Council, I extend a cordial welcome as you virtually gather to enjoy the 38th Annual Science Olympiad National Tournament, and extend best wishes for an enjoyable and successful event.

Founded in 1984, Science Olympiad is one of the premier science competitions in the nation, providing standards-based challenges to nearly 5,000 teams at 375 live and remote tournaments in all 50 states last year. The Science Olympiad National Tournament is the pinnacle of achievement for 120 of the country’s best Science Olympiad teams and the Global Ambassador Team from Japan, representing more than 2,000 students.

This year’s theme, Imagination, captures the spirit of invention and creativity in Caltech’s hometown of Pasadena. From NASA’s Jet Propulsion Laboratory’s Rover on Mars to the innovative research at Caltech, imagination is in the air. Together, Science Olympiad and Caltech will inspire the next generation of STEM superstars, makers and explorers.

I am pleased to extend congratulations to all who participate in Tournament Week, the STEM Expo, and competition day. Keep up the great work!

Sincerely,

VICTOR M. GORDO
Mayor

100 North Garfield Avenue • Pasadena, CA 91105
(626) 744-4311 Fax (626) 744-3921
May 13, 2022

California Institute of Technology
1200 E California Blvd.
Pasadena, CA 91125

Dear Friends,

I am happy to welcome young scientists from across the country to the 38th Annual Science Olympiad National Tournament. This year’s theme, *Imagination*, serves to inspire the next generation of explorers to use creative thinking to discover unknown worlds as well as solve the problems we face here on our own planet. I am inspired by the curiosity of our youth and the spirit of innovation that is in the hearts of the more than 2,000 competitors this week.

The California Institute of Technology has made Pasadena a central hub of global scientific research for over 130 years. Caltech is home to some of the most brilliant scholars and researchers in their fields, and I am proud to represent this outstanding institution and support its groundbreaking research efforts. I admire the dedication Caltech has to encouraging young people’s interest in science and showing that they are limited only by their own dreams.

I send my deepest gratitude to the organizers of this event for their hard work to make this week safe and enjoyable for its participants. I wish the best of luck to all students competing in this year’s Science Olympiad National Tournament.

Sincerely,

Hon. Anthony J. Portantino
Senator, 25th District
NAVIGATING

Autonomous Systems

Caltech
THE 2022 TOURNAMENT COMMITTEE LEADS

Dr. Peter Hung is a Project Leader at The Aerospace Corporation, a Federally Funded Research and Development Center. He received his B.S. in Physics and M.S. and Ph.D. in Applied Physics from Caltech. As a Science Olympiad alum, Peter started Caltech’s involvement with Science Olympiad and later founded the Caltech Science Olympiad Club to provide opportunities for Science Olympiad alumni to give back to Science Olympiad. Though his favorite event in high school was Mission Possible, he was responsible for the creation of events like Gravity Vehicle, Robot Arm, Mousetrap Out and Back and has started the development of new events like Write It CAD It, Digital Structures, and Cybersecurity. He currently serves as the Southern California Science Olympiad State Director and the Bay Area Science Olympiad Regional Director. In 2009, he received the Science Olympiad Heart of Gold Award and served on the National Science Olympiad Advisory Committee from 2017 until 2019, when he started serving on the National Science Olympiad Executive Board. Outside of Science Olympiad, he also serves on the board of several other nonprofits to promote and improve undergraduate research at Caltech and in Southern California. He enjoys tending to his orchids and watching space launches in his spare time.

Jolly Patro is a current junior studying Chemistry from Blacker House at Caltech. Her involvement with Science Olympiad started in 2015 when she joined Olathe North High School's Science Olympiad Team. In her time as a competitor, she and her team qualified for the Kansas State tournament for four years and once to the National Tournament. Some of Jolly’s favorite events are Chemistry Lab, Sounds of Music, and Thermodynamics. She encourages competitors to try events that are different from each other because they may find interest in something that they would have never considered before! Since starting at Caltech, she joined the Caltech Science Olympiad Club and currently serves as its Co-President as well as the National Tournament Co-Director for this year. At Caltech, Jolly also serves as the Co-Secretary of Blacker House, Co-Secretary of the Board of Control, Vice-President of the Chemistry Club, an Ambassador of the Student-Faculty Programs, and a member of the Caltech Orchestra and Chamber Programs. Outside of school and activities, Jolly loves to bake and is always looking for more fun recipes!

Albert Kyi is a current junior studying Chemical Engineering, with a focus in sustainability, from Avery House at Caltech. He currently serves as Co-President of the Caltech Science Olympiad Club and Co-Director for this year's National Tournament. His Science Olympiad competition days began nearly a decade ago, in his sixth grade. When he moved to a new middle school in seventh grade, he took his passion for STEM and started a new Science Olympiad team there. This same passion led him to start yet another Science Olympiad team at his high school. He considers Forensics and Thermodynamics his favorite events and wants to remind competitors to avoid using metal spatulas for flame tests in Forensics, a lesson he learned the painful way. He's proud to be able to contribute to all levels of Science Olympiad tournaments and hopes his leadership will serve as an inspiration to those coming after him. On campus, Albert also serves as the VP of Internal Affairs for the Caltech Y, an on-campus community service and advocacy organization, as well as Secretary of the Caltech Chapter of the American Institute of Chemical Engineers (AIChE). He is also the Head Peer Advocate and Head Health Advocate for Avery House. He enjoys biking and playing volleyball in his free time, and is excited by urban planning and negative carbon emissions technologies. As a proud New Yorker, he will also take anyone up on a slice of Junior's cheesecake or a sandwich at Katz's.
MAY 09 - 18
TOURNAMENT WEEK

TOURNAMENT WEEK SCHEDULE

MONDAY

9

» Panel Discussion: Admissions Discussion with Caltech Students

» Video: Virtual Campus Tour of Caltech

TUESDAY

10

» Discussion: Meet Raymond Ealy of STEAM:CODERS and our joint "Smart to Be Good" fundraiser

» Video: A Look Into Caltech Research Programs

» Hands On Activity: “Chess is STEM” webinar with ChessKid

WEDNESDAY

11

» EXPO Talks:
  - "From SciOly Astronomy to Real Photos of Exoplanets" with Briley Lewis, UCLA PhD Candidate in Astronomy
  - "The Future of Dermatology Research" with Ernest Lee, MD, PhD, physician scientist
  - "From Bioinformatics to Machine Learning" with David Fan, applied research scientist

» Video: Finding a Home in College Through Science Olympiad

» Video: CDC NERD Academy Session

THURSDAY

12

» EXPO Talks:
  - "Engineering Antibodies to Target Disease" with Phil Liu, Stanford PhD Candidate in Biophysics
  - "Science in Hiding: Finding science in the kitchen and on the stage" with Jeffrey Rubel, edtech strategy director and historian of science
  - "Bringing Computer Science to All" with Leigh Ann DeLyser, PhD, executive director of CSforAll

» Video: Learn about Caltech’s innovations in robotics

FRIDAY

13

» Opening Ceremony

SATURDAY

14

» Online Competition on Scilympiad Platform

WEDNESDAY

18

» Awards Ceremony
Frances Arnold became the first American woman to win the Nobel Prize in Chemistry in 2018, and in 2019 was the first and only woman to make a cameo appearance on *The Big Bang Theory*. She still has a SAG-AFTRA contract to play herself, but unfortunately the beloved TV show is over, after 12 seasons. She still has a job, however, as the Linus Pauling Professor of Chemical Engineering, Bioengineering, and Biochemistry at the California Institute of Technology, where her group develops and uses directed evolution to create new DNA-encoded chemistry for applications in sustainable fuels and chemicals, agriculture, medicine and materials. She was awarded the National Medal of Technology and Innovation by President Obama in 2011 and was appointed co-Chair of the President’s Council of Advisors on Science and Technology by Joe Biden in 2021. She earned a BS degree in Mechanical and Aerospace Engineering and a PhD in Chemical Engineering.
OPENING CEREMONY
FRIDAY
MAY 13, 2022
5pm PT

Welcome Remarks from Jenny Kopach, Science Olympiad CEO
Welcome from Caltech President Thomas Rosenbaum
Welcome from The Aerospace Corporation CEO Steven Isakowitz
National Anthem
Parade of States Video
Affirmation of Code of Ethics and Pledges
Japan Global Ambassador Team Welcome
Keynote Speech from Nobel Prize Winner Dr. Frances Arnold
Announcement of $50,000 Founders’ Scholarships

AWARDS CEREMONY
WEDNESDAY
MAY 18, 2022
5pm PT

Welcome Remarks from Jenny Kopach, Science Olympiad CEO
Sponsor and Partner Gratitude
Thanks to the Japan Global Ambassador Team
Science Olympiad Spirit Awards
Announcement of the Winners of the 2022 Science Olympiad National Tournament
Welcome from the 2023 Science Olympiad Tournament Host, Wichita State University
Student participants are expected to compete in tournament events with honest effort to follow the rules and the spirit of the competition. Team members are expected to be the builders of all the devices used in the events. The goal of competition is to give one’s best effort while displaying honesty, integrity, and sportsmanship. Failure to show honesty and/or courtesy by a participant, coach or guest of the team may result in the disqualification of the team from that event, the entire tournament or future tournaments.

I pledge to put forth my best effort in the Science Olympiad tournament and to uphold the principles of honest competition. In my events, I will compete with integrity, respect, and sportsmanship towards my fellow competitors. I will display courtesy towards Event Supervisors and Tournament Personnel. My actions will exemplify the proud spirit of my school, team, and state.

On behalf of the coaches and assistants at this tournament, I pledge to encourage honesty and respect for tournament personnel, our fellow coaches, and other team members. We want our efforts to bring honor to our community and school.

On behalf of the parents and spectators I pledge to be an example for our children by:
- Respecting the rules of Science Olympiad
- Encouraging excellence in preparation and investigation
- Supporting independence in design and production of all competition devices
- Respecting the decisions of event supervisors and judges.

Our examples will promote the spirit of cooperation within and among all our participating teams.

On behalf of my fellow supervisors and tournament personnel, I pledge to run my event with fairness and respect for the participants and their coaches. Our actions will reflect the principles of the Science Olympiad program and display the pride we feel as representatives of our colleges, universities, companies, states or organizations.
2022 NATIONAL EVENTS

DIVISION B

ANATOMY & PHYSIOLOGY
BIO PROCESS LAB
BRIDGE
CODEBUSTERS
CRAVE THE WAVE
CRIME BUSTERS
DISEASE DETECTIVES
DYNAMIC PLANET
ELECTRIC WRIGHT STUFF

EXPERIMENTAL DESIGN
FOOD SCIENCE
GREEN GENERATION
METEOROLOGY
MISSION POSSIBLE
MOUSETRAP VEHICLE
ORNITHOLOGY
PING PONG PARACHUTE
ROAD SCHOLAR

ROCKS & MINERALS
SOLAR SYSTEM
SOUNDS OF MUSIC
STORM THE CASTLE
WRITE IT DO IT
BOTANY (TRIAL)
DIGITAL STRUCTURES (TRIAL)
WRITE IT CAD IT (TRIAL)

DIVISION C

ANATOMY & PHYSIOLOGY
ASTRONOMY
BRIDGE
CELL BIOLOGY
CHEMISTRY LAB
CODEBUSTERS
DETECTOR BUILDING
DISEASE DETECTIVES
DYNAMIC PLANET

ENVIRONMENTAL CHEMISTRY
EXPERIMENTAL DESIGN
FORENSICS
GRAVITY VEHICLE
GREEN GENERATION
IT'S ABOUT TIME
ORNITHOLOGY
PING PONG PARACHUTE
REMOTE SENSING

ROCKS & MINERALS
TRAJECTORY
WIFI LAB
WRIGHT STUFF
WRITE IT DO IT
BOTANY (TRIAL)
CYBERSECURITY (TRIAL)
DIGITAL STRUCTURES (TRIAL)
WRITE IT CAD IT (TRIAL)
DIVISION B EVENT DESCRIPTIONS

COMPETITION EVENTS

**Anatomy & Physiology** – Participants will be assessed on their understanding of the anatomy and physiology for the human Nervous, Sense Organs, and Endocrine systems.

**Bio Process Lab** – This event is a lab-oriented competition involving the fundamental science processes of a middle school life science/biology lab program.

**Bridge** – Teams will design and build a Bridge (Structure) meeting requirements specified in these rules to achieve the highest structural efficiency.

**Codebusters** – Teams will cryptanalyze and decode encrypted messages using cryptanalysis techniques for historical and modern advanced ciphers.

**Crave the Wave** – In this event competitors must demonstrate knowledge and process skills needed to solve problems and answer questions regarding all types of waves and wave motion.

**Crime Busters** – Given a scenario, a collection of evidence, and possible suspects, students will perform a series of tests. The test results along with other evidence will be used to solve a crime.

**Disease Detectives** – Participants will use their investigative skills in the scientific study of disease, inquiry, health, and disability in populations or groups of people.

**Dynamic Planet** – Students will use process skills to complete tasks related to Earth’s fresh waters.

**Electric Wright Stuff** – Prior to the tournament teams design, construct, and test free flight electric-powered monoplanes to achieve maximum time aloft.

**Experimental Design** – This event will determine the participant’s ability to design, conduct, and report the findings of an experiment entirely on-site.

**Food Science** – Students will answer questions on food chemistry with a focus on sugars. In addition, participants will build a hydrometer capable of measuring sugar solutions between 1-10% (mass/volume).

**Green Generation** – Students will demonstrate an understanding of general ecological principles, the history and consequences of human impact on our environment, solutions to reversing trends and sustainability concepts.

**Meteorology** – Participants will use scientific process skills and quantitative analysis to demonstrate an understanding of the factors that influence world climate and climate change through the interpretation of climatological data, graphs, charts and images.

**Mission Possible** – Prior to the competition, participants design, build, test and document a Rube Goldberg-like device that completes required Start and Final Actions through a series of specific actions.

**Mousetrap Vehicle** – Teams design, build and test one vehicle using one or two mousetrap(s) as its sole means of propulsion to reach a target as quickly and accurately as possible.

**Ornithology** – Participants will be assessed on their knowledge of North American birds.

**Ping Pong Parachute** – Prior to the tournament, teams will design, build and bring up to three bottle rockets to the tournament to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

**Road Scholar** – Participants will answer interpretative questions that may use one or more state highway maps, USGS topographic maps, Internet-generated maps, a road atlas, or satellite/aerial images.

**Rocks & Minerals** – Teams will demonstrate their knowledge of rocks and minerals.

**Solar System** – Students will demonstrate an understanding and knowledge of planet formation and structure in our solar system and how it relates to that observed in extrasolar systems.

**Sounds of Music** – Teams must construct and tune one device prior to the tournament based on a one-octave 12-tone equal tempered scale and complete a written test on the physics of sound and music concepts.

**Storm the Castle** – Prior to the competition, teams will design, construct and calibrate a single device capable of launching projectiles onto a target and collect data regarding device parameters and performance.

**Write It Do It** – One participant will write a description of an object and how to build it. The other participant will attempt to construct the object from this description.

**TRIAL EVENTS**

**Botany** – Participants will demonstrate their knowledge of plant life and general botany principles.

**Digital Structures** – Teams will design and test a Bridge using SkyCiv structural analysis software that meets requirements specified in these rules to achieve the highest structural efficiency while withstanding multiple vertical and lateral loads.

**Write It CAD It** – One participant will write a description of an object and how to build it. The other participant will attempt to construct the object in a computer-aided design (CAD) software from this description.
Mission Possible – Prior to the competition, participants design, build, test and document a Rube Goldberg-like device that completes required Start and Final Actions through a series of specific actions.

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Anatomy & Physiology – Participants will be assessed on their understanding of the anatomy and physiology for the human Nervous, Sense Organs, and Endocrine systems.

Astronomy – Teams will demonstrate an understanding of Variability of Low & Mid-Mass Stars.

Bridge – Teams will design and build a Bridge (Structure) meeting requirements specified in these rules to achieve the highest structural efficiency.

Cell Biology – This event integrates content knowledge and process skills in the areas of cell biology and cellular biochemistry.

Chem Lab – Teams will complete one or more tasks and answer a series of questions involving the science processes of chemistry focused in the areas of Aqueous Solutions and Oxidation/Reduction.

Codebusters – Teams will cryptanalyze and decode encrypted messages using cryptanalysis techniques for historical and modern advanced ciphers.

Detector Building – Teams will build a durable Conductivity Device that will accurately measure and display both voltage and concentrations of NaCl in parts per million (ppm) from 0 to 5000 ppm of different water samples.

Disease Detectives – Participants will use their investigative skills in the scientific study of disease, inquiry, heath, and disability in populations or groups of people.

Dynamic Planet – Students will use process skills to complete tasks related to Earth’s fresh waters.

Environmental Chemistry – This event will focus on fresh water (e.g., residential, industrial or natural), The Clean Water Act of 1972 and 1977, wastewater operator’s certification manual (Indiana March 2018 version) and its applications, and various testing of particular analytes using standardized curves, either interpreted or created.

Experimental Design – This event will determine the participant’s ability to design, conduct and report the findings of an experiment entirely on-site.

Forensics – Given a scenario and some possible suspects, students will perform a series of tests. These tests, along with other evidence or test results, will be used to solve a crime.

Gravity Vehicle – Teams design, build and test one Vehicle and Ramp that uses the Vehicle’s gravitational potential energy as its sole means of propulsion to reach a target as quickly and accurately as possible.
Green Generation – Students will demonstrate an understanding of general ecological principles, the history and consequences of human impact on our environment, solutions to reversing trends and sustainability concepts.

It’s About Time – Teams will answer questions related to time and they may construct and bring one non-electrical device to measure time intervals between 10 and 300 seconds.

Ornithology – Participants will be assessed on their knowledge of North American birds.

Ping-Pong Parachute – Prior to the tournament, teams will design, build and bring up to three bottle rockets to the tournament to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

Remote Sensing – Participants will use remote sensing imagery, data and computational process skills to complete tasks related to climate change processes in the Earth system.

Rocks and Minerals – Teams will demonstrate their knowledge of rocks and minerals.

Trajectory – Prior to the competition, teams will design, construct and calibrate a single device capable of launching projectiles onto a target and collect data regarding device parameters and performance.

WiFi Lab – Teams must construct an antenna device prior to the tournament that is designed to transmit a signal at 2.4GHz and complete a written test on the principles of electromagnetic wave propagation.

Wright Stuff – Prior to the competition teams design, construct and test free flight rubber-powered monoplanes to achieve maximum time aloft.

Write It Do It – One student will write a description of an object and how to build it, and then the other student will attempt to construct the object from the description.

TRIAL EVENTS

Botany – Participants will demonstrate their knowledge of plant life and general botany principles.

Cybersecurity – Competitors will be assessed on their knowledge of cybersecurity through hands-on tasks as well as theoretical questions focused in the areas of cryptography and web architecture.

Digital Structures – Teams will design and test a Bridge using SkyCiv structural analysis software that meets requirements specified in these rules to achieve the highest structural efficiency while withstand multiple vertical and lateral loads.

Write It CAD It – One participant will write a description of an object and how to build it. The other participant will attempt to construct the object in a computer-aided design (CAD) software from this description.
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<thead>
<tr>
<th>State</th>
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<th>School Name</th>
<th>Coach</th>
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<td>B35</td>
<td>Our Lady of the Valley Catholic School</td>
<td>Lori Steele</td>
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<td>B40</td>
<td>BASIS Mesa</td>
<td>Felecia Scanlan</td>
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<td>B54</td>
<td>LISA Academy West Middle School</td>
<td>Kirsten Ritchie</td>
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# DIVISION C PARTICIPATING SCHOOLS

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## TOURNAMENT DAY SCHEDULE - DIVISION B

**SATURDAY, MAY 14**

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<td>Trial Events (Botany, Digital Structures, Write It CAD It)</td>
<td>3:50 AM</td>
<td>6:50 AM</td>
<td>7:50 AM All Teams Except HI, AZ, CA, OR, WA, NV</td>
<td>8:50 AM All Teams Except HI, AZ, CA, OR, WA, NV</td>
<td>9:50 AM All Teams Except HI, AZ, CA, OR, WA, NV</td>
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<td>Crave the Wave, Green Generation, Rocks &amp; Minerals</td>
<td>5:00 AM</td>
<td>8:00 AM All Teams Except HI</td>
<td>9:00 AM All Teams Except HI</td>
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<td>Codebusters, Meteorology, Ornithology</td>
<td>6:10 AM</td>
<td>9:10 AM All Teams Except HI</td>
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<td>Anatomy &amp; Physiology, Dynamic Planet</td>
<td>7:20 AM</td>
<td>10:20 AM All Teams Except HI</td>
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<tr>
<td>Bio Process Lab, Crime Busters, Experimental Design</td>
<td>8:30 AM All Teams</td>
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<td>Disease Detectives, Road Scholar, Write It Do It</td>
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<tr>
<td>Food Science, Solar System, Sounds of Music (Test Only)</td>
<td>10:50 AM All Teams</td>
<td>1:50 PM All Teams</td>
<td>2:50 PM All Teams</td>
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<td>Crave the Wave, Green Generation, Rocks &amp; Minerals</td>
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<td>7:20 PM</td>
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Times in **red** are for Event Supervisor reference only. No team will compete in the main Tournament (non-Trial Events) prior to 8:00 AM local time.

### SELF-SCHEDULED EVENTS

- Bridge
- Electric Wright Stuff
- Mission Possible
- Mousetrap Vehicle
- Ping Pong Parachute
- Sounds of Music (Performance)
- Storm the Castle
- Available Event Slots start @ 8:00 AM (PDT).
### TOURNAMENT DAY SCHEDULE - DIVISION C
SATURDAY, MAY 14

#### BLOCK EVENTS

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<td>All Teams Except HI, AZ, CA, OR, WA, NV</td>
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<tr>
<td>Codebusters, Dynamic Planet, Ornithology</td>
<td>5:00 AM</td>
<td>8:00 AM</td>
<td>9:00 AM</td>
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<td>Disease Detectives, It’s About Time (Test), Remote Sensing</td>
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<td>2:30 PM</td>
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<td>All Teams</td>
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<tr>
<td>Cell Biology, Experimental Design, Forensics</td>
<td>9:40 AM</td>
<td>12:40 PM</td>
<td>1:40 PM</td>
<td>2:40 PM</td>
<td>3:40 PM</td>
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<tr>
<td>Anatomy &amp; Physiology, Astronomy, Environmental Chemistry</td>
<td>10:50 AM</td>
<td>1:50 PM</td>
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<tr>
<td>Codebusters, Dynamic Planet, Ornithology</td>
<td>12:00 PM</td>
<td>3:00 PM</td>
<td>4:00 PM</td>
<td>5:00 PM</td>
<td>6:00 PM</td>
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<tr>
<td>HI</td>
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<tr>
<td>Trial Events (Botany, Cybersecurity, Digital Structures, Write It CAD It)</td>
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<td>AZ, CA, OR WA, NV</td>
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<tr>
<td>Disease Detectives, It’s About Time (Test), Remote Sensing</td>
<td>1:10 PM</td>
<td>4:10 PM</td>
<td>5:10 PM</td>
<td>6:10 PM</td>
<td>7:10 PM</td>
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<td>HI</td>
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<tr>
<td>Detector Building (Test), Green Generation, Rocks &amp; Minerals</td>
<td>2:20 PM</td>
<td>5:20 PM</td>
<td>6:20 PM</td>
<td>7:20 PM</td>
<td>8:20 PM</td>
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<td>HI</td>
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<td>All Teams</td>
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</table>

Times in red are for Event Supervisor reference only. No team will compete in the main Tournament (non-Trial Events) prior to 8:00 AM local time.

#### SELF-SCHEDULED EVENTS

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Available Event Slots</th>
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<tbody>
<tr>
<td>Bridge</td>
<td>start @ 8:00 AM (PDT)</td>
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<tr>
<td>Detector Building (Device)</td>
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<tr>
<td>Gravity Vehicle</td>
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<tr>
<td>It’s About Time (Device)</td>
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<tr>
<td>Ping Pong Parachute Trajectory</td>
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<tr>
<td>WiFi Lab (Device)</td>
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<tr>
<td>Wright Stuff</td>
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</table>

TOURNAMENT DAY SCHEDULE
In 2009, Board Members Dr. Gerard Putz and Jim Woodland traveled to Tokyo, Japan, to present Science Olympiad concepts to Japanese education officials from the Ministry of Education (MEXT) and the Japan Science and Technology Agency (JST) at "Science Agora." A partnership between Science Olympiad and JST was born, founded on a shared passion for making science competition fun and exciting for all students.

In April 2022, JST hosted its 11th Annual Japan High School Science Championships (JHSSC), where the Grand Prize for High School at Komaba, University Tsukuba is a chance to participate in the 2022 Science Olympiad National Tournament presented in partnership with Caltech. As they have done at previous National Tournaments, Japanese students will join their American peers online in tests, march in the virtual Parade of States and participate as unranked guests in selected Science Olympiad events.

Please welcome the 2022 JHSSC Winners and Coach from High School at Komaba, University Tsukuba to the National Tournament!
IMAGINATION IS THE SPARK THAT IGNITES THE FIRE OF CREATIVITY

Richard L. Peterson
<table>
<thead>
<tr>
<th>State Directors</th>
<th>State Directors</th>
<th>State Directors</th>
<th>State Directors</th>
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<tbody>
<tr>
<td>Mary Lou Ewald</td>
<td>Dan Nichols</td>
<td>Susan Hester</td>
<td>Dr. David Stanislawski</td>
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<tr>
<td>Alabama</td>
<td>Indiana</td>
<td>Nebraska</td>
<td>Tennessee</td>
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<tr>
<td>Chris Gooch</td>
<td>Dr. Jill Maroo</td>
<td>Tracy Viscosi</td>
<td>Dr. Nancy Magnussen</td>
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<td>Alaska</td>
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<td>Nevada</td>
<td>Texas</td>
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<td>Reina Gomez</td>
<td>Jill Fisher</td>
<td>Dr. Nicole Eyet</td>
<td>Dr. Carrie Jo Bucklin</td>
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<td>Arizona</td>
<td>Kansas</td>
<td>New Hampshire</td>
<td>Utah</td>
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<td>Dr. Eric Kaufmann</td>
<td>Taylor Blair</td>
<td>Dr. Jennifer Wirt</td>
<td>New Jersey</td>
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<td>Dr. Leon Walls</td>
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<td>Barbara Little</td>
<td>Bruce Sherman</td>
<td>Dr. Sharon Sessions</td>
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<td>David Sturm</td>
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<td>Dr. Robert Bruce</td>
<td>Kim Gervase</td>
<td>Dr. Sachiko McBride</td>
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<td>Dr. Brian Niece</td>
<td>Dr. Azer Akhmedov</td>
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<td>North Dakota</td>
<td>Wisconsin</td>
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<td>Martha Moore</td>
<td>Joel Nelson</td>
<td>Dr. Paul Marquard</td>
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<td>Wyoming</td>
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<td>Susan Karpatkin</td>
<td>Paul Voydanoff</td>
<td>Bob Melton</td>
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<td>Michigan</td>
<td>Oklahoma</td>
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<td>Valerie Ledford</td>
<td>Brandi Gordon</td>
<td>Ashley da Silva</td>
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<td>Katie Foley</td>
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<td>Greg Spiegel</td>
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<td>Joe Simmons</td>
<td>Suzi Taylor</td>
<td>Dr. Jennifer Albert</td>
<td>South Dakota</td>
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<tr>
<td>Illinois</td>
<td>Montana</td>
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# NATIONAL EVENT SUPERVISORS

## DIVISION B EVENT SUPERVISORS

<table>
<thead>
<tr>
<th>Event</th>
<th>Lead Supervisor</th>
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<tr>
<td>Anatomy &amp; Physiology</td>
<td>Ashwin Ghadiyaram</td>
<td>Meteorology</td>
<td>Hugo Yu</td>
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<tr>
<td>Bio Process Lab</td>
<td>Greg Palmer</td>
<td>Mission Possible</td>
<td>Manley Midgett</td>
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<tr>
<td>Botany</td>
<td>Matt Kramer</td>
<td>Mousetrap Vehicle</td>
<td>Conen Morgan</td>
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<tr>
<td>Bridge</td>
<td>Greg Marconnet</td>
<td>Ornithology</td>
<td>Dennis Papesha</td>
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<tr>
<td>Codebusters</td>
<td>Caleb Chiang</td>
<td>Ping Pong Parachute</td>
<td>Dan Hartley</td>
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<tr>
<td>Crime Busters</td>
<td>Russ Burleson</td>
<td>Road Scholar</td>
<td>Kathy Hartley</td>
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<tr>
<td>Digital Structures</td>
<td>Adrian Huang</td>
<td>Solar System</td>
<td>David Zheng</td>
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<td>Disease Detectives</td>
<td>George Sun</td>
<td>Sounds of Music</td>
<td>Brendan Herlihy</td>
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<td>Dynamic Planet</td>
<td>Ernest Lee</td>
<td>Storm the Castle</td>
<td>Emily Miaou</td>
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<td>Electric Wright Stuff</td>
<td>Anand Gnanadesikan</td>
<td>Write It CAD It</td>
<td>Aditya Shah</td>
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<td>Experimental Design</td>
<td>Jeff Anderson</td>
<td>Write It Do It</td>
<td>Dave Moyer</td>
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<td>Food Science</td>
<td>Jasmine Windsor</td>
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<td>Green Generation</td>
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<td>Shelly Fitzgerald</td>
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## DIVISION C EVENT SUPERVISORS

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<td>Phillip Liu</td>
<td>Forensics</td>
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<td>Astronomy</td>
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<td>Steph Gu</td>
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<td>Chuck Stachovic</td>
<td>It's About Time</td>
<td>Karen Emmons</td>
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<td>Cell Biology</td>
<td>Annika Gomez</td>
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<td>Chemistry Lab</td>
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<td>Miriam Sun</td>
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<td>Experimental Design</td>
<td>Peter Zhu</td>
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<td>Eric Rowley</td>
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Jaehyun Ahn
Eric Amaro
Brian Amaro
Ariel Anchanattu
Chuck Andraka
Christopher Anisi
Carlos Ayala
Lauren Bajo-Smith
Alan Bao
Colin Barber
John Beauregard
Maddy Bender
Allison Birbal
Bryan Blaschke
Michael Bouklas
Cameron Brown
Patrick Cai
Dangli Cao
Lynn Rose Cardenas
Jason Chang
Allen Chang
Stephanie Chen
Chloe Cheng
Nikki Cheung
Emmet Cleary
Evan Dicker
KhueDang Doan
Dave Drummer
Benny Ehler
Kira Emmons
Scott Evoy
Matthew Evoy
Zoe Goldblum
Jareth Gomes
Conor Gowder
Katherine He
Tingzhi He
Beth Heger
Victor Hesu
Brian Hoffman
Ryan Hon
Wesley Huang
Johnny Huang
Emma Isella
Jenny Ji
Dhruva Karkada
Christina Kasch
David Kessler
Ryungin Kim
Claire Kim
Jiwoo Kim
Sulekha Kishore
Mark Kramer
Pranit Kumaran
Emerson Lai
Stephanie Lamb
Robert Lee
Nicole Lee
Ian Lee
Adelaide Leung
Haoyu Li
Jeanie Liang
Seth Lieblich
Ethan Lin
Yi Lin
Kristi Liu
Renee Long
Megan Luo
Christopher Luo
Lucas Mansfield
Scott Maurer
Ryan Mayden
Chris Mistron
Alanna Mori
Samyok Nepal
Harrison Ngue
Tuan Nguyen
Nga Nguyen
Owen Noga
Angelica Olmedo
Seohyun Park
Akshay Patwardhan
Anson Pham
Kelly Pham
Sahil Pontula
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Pete Rado
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Michael Taleff
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Connor Todd
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Vivek Vajipey
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Ethan Vien
Erin Wang
Yibo Vien
Clara Wang
Tate Welty
Colton Werner
Olivia White
Ava Wu
Iris Xia
Daniel Xie
Miyu Yamane
John Yang
Harry Yang
Aidan York
Donna Young
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Maiya Yu
Felix Zhan
Andrew Zhang
Camille Zhang
Catherine Zheng
Eric Zheng
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