



Exploring the World of Science

Division B Rules Manual

Division B (Gr. 6-9)

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WELCOME TO THE 2021 SCIENCE OLYMPIAD!

This Rules Manual will help you prepare to compete in Invitational, Regional, State and National Tournaments held across the United States annually. Each Science Olympiad event has a corresponding page on the Science Olympiad national website complete with free resources, training handouts and useful links. All users of this manual are subject to the Terms of Use Agreement. To compete, users must first join the Science Olympiad program in their home state and become registered members.

See our website for info on Membership, Policies and Terms of Use at www.soinc.org

Division C (Grades 9-12) Membership Rules

A team may have up to fifteen (15) members. A maximum of seven (7) 12th grade students is permitted on a Division C team.

Division B (Grades 6-9) Membership Rules

A team may have up to fifteen (15) members. A maximum of five (5) 9th grade students is permitted on a Division B team. Because middle schools that do not have grades 7, 8 or 9 are at a slight disadvantage, they may invite any combination of up to five (5) of their last year's 6th, 7th or 8th grade students to be part of the team. Possible examples can be found on the Science Olympiad website.

Students Below Grade Level Designations

Science Olympiad encourages students to participate in the Division that matches current Science Olympiad grade level designations. However, to support the inclusion of students who wish to participate in Science Olympiad, schools with grade levels lower than those stated in a Division are permitted to invite members below the grade level designations. Participation is limited to age-appropriate events (as determined by a coach, principal or tournament director) and prohibited where safety is a concern (such as the use of chemicals). See Team Qualifications for more information.

Science Olympiad Team Membership

Science Olympiad requires that all teams (up to 15 members) competing in any Science Olympiad Tournament (Invitational, Regional, State or National) must be a member of Science Olympiad and pay the national fee (currently \$60, paid as part of the state membership). There is no exception to this requirement, regardless of what teams from the same school are called (Varsity, JV, Alternate Team, Extra Team, Team Two, Team B). No school, region or state Science Olympiad organization is allowed to alter or amend these national membership requirements. Please see the Science Olympiad Copyrights and Use Statement outlining use of Science Olympiad Rules and procedures at sanctioned tournaments.

Find more Science Olympiad team information under the Policies section of the national website: Code of Ethics & Rules, Scoring Guidelines, Home & Virtual Schools, Small Schools, All Stars, Copyrights and Use, Lasers, Building Policy, Eye Protection, Significant Figures and Wristband Procedures.

SCIENCE OLYMPIAD KITS AND RESOURCES AVAILABLE NOW!

Please visit store.soinc.org to purchase 2021 print manuals, video downloads, test packets and other event resources for Division B, Division C and Elementary Science Olympiad. Order officially licensed Science Olympiad Kits, supplies and parts for a variety of 2021 Science Olympiad events with your Fall Early Bird Savings: Save 12% on your Ward's Science Olympiad Kit order at wardsci.com/scienceolympiad with promo code SOVIP2020. Don't wait! This limited-time offer ends 12/31/20.



Exploring the World of Science

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SCIENCE OLYMPIAD

DIVISION B RULES MANUAL

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- Please read the General Rules on the next page - they apply to all events. Note: all changes are in **bold**.
- Please visit the official Science Olympiad web site: www.soinc.org for Membership Information, Team Size Requirements, Clarifications/Rules Changes, FAQs, New Store Items, news, tips, resources, and other valuable information.

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TOURNAMENT FORMATS

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

While the COVID-19 situation still changes daily, Science Olympiad has developed a series of models for tournaments which will allow State Chapters to start the season with enough options and flexibility to provide registered Science Olympiad teams with a safe and positive experience, no matter how students are learning or how local situations evolve. These models are the result of thoughtful conversations that spanned the entire Science Olympiad community. We would like to thank everyone for their candor, thoughtfulness, and creativity. In the end, we feel we were able to create options that acknowledge that circumstances vary across the US while maintaining the spirit and goals of the organization.

In-Person, Single-Location Tournaments - The Gold Standard

The expectation for the 2021 season is that if health conditions in your region/state allow for traditional in-person, single-location tournaments, your State Chapter will provide that experience for teams, qualifying them all the way through to our 2021 Science Olympiad National Tournament at Arizona State University on May 21-22, 2021. In order to achieve this expectation, our State Chapters are ready to provide accommodations due to local public health regulations. Additionally, participants will be asked to sign a COVID-19 release.

Satellite SO

This is a new model that accounts for situations where students are physically attending school, but large public gatherings in a single location are prohibited. A Satellite SO Tournament will take place over the course of a few days after school with each team competing from their own school. This format requires that Tournaments use tech tools that schools and teachers have been using these last few months like Zoom, Google Classroom, Google Meet, Microsoft Teams and Facebook Live that have opened up new ways to communicate, learn and gather for events. This model presents shortfalls when compared to a traditional tournament, especially with regard to the scope of hands-on activity, but it capitalizes on the amount of time Science Olympiad teams are encouraged to spend in months-long preparation for competition – building, breaking, studying, making binders, taking quizzes, and prepping log books. Teams will need to accept these limitations willingly, understand the academic honor code will be in full force, and that they will need to abide by a safety agreement provided by Science Olympiad, Inc.

Mini SO

This model accounts for situations where students are unable to physically attend school and are distance learning from their homes by allowing some events to be run at home. Since students will be at home without faculty supervision, no hands-on events will be allowed to run. A chart showing acceptable events can be found online at soinc.org. As with Satellite SO, this model presents shortfalls when compared to a traditional tournament, especially with regard to the scope of hands-on activity. Teams will need to accept these limitations willingly and understand the academic honor code will be in full force. This model can be delivered through a variety of tech platforms, via email, or even postal mail if needed.

A Science Olympiad tournament typically consists of 23 different events, and those 23 events can be classified into one of four event types. This information is being provided so that Science Olympiad participants can more easily identify events that they may enjoy competing in, regardless of the event content. Coaches can approach coaching from the perspective of event type as opposed to event content, and teams can be aware of how the format of the tournament might affect available events. The symbol to the left of each description has been added to the upper right-hand corner of each Event Rule to identify the event type.



Core Knowledge Event: An event where participants are given a set of topics that they are expected to research and master the factual content. Mastery is demonstrated at a tournament by taking a paper-pencil, station, and/or computer test.

Core Knowledge Events can be run regardless of the tournament format that has been chosen by the State Chapter and the Tournament Director.



Build Event: An event where participants are given some specifications about a device or object they are expected to design, create, and test in advance of the tournament. The devices or objects are often modified on site to account for an unknown parameter prior to testing or evaluation.

In some cases, Build Events may or may not be run depending upon the format of Science Olympiad tournament being conducted. The Tournament Director will make these decisions to ensure safety and fairness for all teams. If a Build Event is not to be run at a tournament, the Tournament Director will notify all teams in advance of the given tournament.



Laboratory/Hands-On Event: An event where participants are given a general topic in which they will be expected to deepen their content knowledge of the topic and associated research techniques prior to the tournament. At the tournament they will be assessed by the completion of a hands-on task, which may or may not require a written report, within a defined timeframe.

Depending upon the format of Science Olympiad Tournament being held, there may be some alterations to or cancellation of Lab Events. To the greatest extent possible, Tournament Directors will work to ensure Lab Events are conducted, though that may mean hands-on activities are omitted and participants will work with previously collected data. The Tournament Director will make these decisions to ensure safety and fairness for all teams. If a Lab Event is altered or not to be run at a tournament, the Tournament Director will notify all teams in advance of the given tournament.



Hybrid Event: An event which combines elements from two or more of the above event types. The most common combination mixes elements of a Core Knowledge Event with elements of a Build or Lab Event.

As with the previous events, Hybrid Events may be altered to fit the format of the Science Olympiad Tournament being held. This may mean that Lab or Build elements of the event are modified or not conducted. The Tournament Director will make these decisions to ensure safety and fairness for all teams. If a Hybrid Event is altered or not to be run at a tournament, the Tournament Director will notify all teams in advance of the given tournament.



GENERAL RULES

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

GENERAL RULES, CODE OF ETHICS, AND SPIRIT OF THE PROBLEM

The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect - see Science Olympiad Pledges. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage). Failure by a participant, coach, or guest to abide by these codes, accepted safety procedures, or rules below, may result in an assessment of penalty points or, in rare cases, disqualification by the tournament director from the event, the tournament, or future tournaments.

1. Actions and items (e.g., tools, notes, resources, supplies, electronics, etc.) are permitted, unless they are explicitly excluded in the rules, are unsafe, or violate the spirit of the problem.
2. While competing in an event, participants may not leave without the event supervisor's approval and must not receive any external assistance. All electronic devices capable of external communication as well as calculator applications on multipurpose devices (e.g., laptop, phone, tablet) are not permitted unless expressly permitted in the event rule or by an event supervisor. Cell phones, if not permitted, must be turned off. At the discretion of the event supervisor, participants may be required to place their cell phones in a designated location.
3. Participants, coaches and other adults are responsible for ensuring that any applicable school or Science Olympiad policy, law, or regulation is not broken. All Science Olympiad content such as policies, requirements, clarifications/changes and FAQs on www.soinc.org must be treated as if it were included in the printed rules.
4. All pre-built devices presented for judging must be constructed, impounded, and operated by one or more of the 15 current team members unless stated otherwise in the rules. If a device has been removed from the event area, appeals related to that device will not be considered.
5. Officials are encouraged to apply the least restrictive penalty for rules infractions - see examples in the Scoring Guidelines. Event supervisors must provide prompt notification of any penalty, disqualification or tier ranking.
6. State and regional tournament directors must notify teams of any site-dependent rule or other rule modification with as much notice as possible, ideally at least 30 days prior to the tournament.

COVID-19 PANDEMIC RULES MODIFICATIONS

The COVID-19 pandemic requires that some general modifications be made to the Event Rules listed in this manual in order to permit Science Olympiad competitions to continue in a way that reflects best public health, disease prevention, and personal safety practices. The modifications listed here will be in effect for all Science Olympiad competitions, regardless of level (e.g., Invitational, Regional, State, National), or type (e.g., In-Person, Satellite SO, mini SO). As the pandemic is evolves, these modifications may be amended or rescinded according to local conditions. If changes are made, the Tournament Director for the affected tournament will make an announcement to all participating teams as soon as possible.

1. **If not already allowed, each individual participant can have a personal set of reference materials (e.g., binders, single sheets of paper), calculator, or other academic resource as specified in the specific event rule for use during the competition to facilitate social distancing, isolation, and to prevent resource sharing. Personal sets of resource materials must meet all the criteria established in the specific event rule. This does not apply to Recommended Lab Equipment for Division B or Division C Chemistry Events or tool kits for Build Events.**
2. **Given local conditions, participants may not be able to be in the same location as their partner during competition. Tournaments will allow designated partners to compete from separate locations and competing teams will only need one device for Build or Hybrid with Build Events.**
3. **At the discretion of the Tournament Director, portions of Hybrid Events containing hands-on activities as well as Build and Lab Events may be dropped from the tournament or be conducted as trial events.**
4. **At the discretion of the Tournament Director and Event Supervisors, completion time may be used as a tiebreaker for Core Knowledge and other events where a written or online test is used.**



1. **DESCRIPTION:** Participants will be assessed on their understanding of the anatomy and physiology for the human Integumentary, Skeletal, and Muscular systems.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

Each team may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed along with two stand-alone non-programmable, non-graphing calculators.

3. **THE COMPETITION:**

Participants will complete a written test limited to the following topics.

- a. **INTEGUMENTARY SYSTEM:**

- i. Functions of the Integumentary System
- ii. Anatomy of the layers of the skin, the component parts of the skin and sensory receptors
- iii. Skin Color and Texture, Hair and Nails, Integumentary Glands and the effects of aging on the skin
- iv. The diseases on each level from the cell to the whole person as listed: allergies to allergens (i.e., poison ivy, metals), infections (i.e., boils, carbuncles, athlete's foot, impetigo, **acne, human papilloma virus (HPV), other types of dermatitis**) and skin cancer
- v. **Injuries to the skin: burns, bedsores, calluses, and scars**
- vi. **National Tournament Only:**
 - (1) Additional disorders: Psoriasis, scabies, **ringworm, herpes, yeast infection, eczema & albinism**
 - (2) Treatments and/or prevention for all conditions listed above (drugs, surgery, etc.)
 - (3) **Aspects of wound healing including, but not limited to: inflammation, necrosis, apoptosis, vasodilation, and clotting**

- b. **SKELETAL SYSTEM:**

- i. Bones of the axial and appendicular skeleton; label the basic surface anatomy of a bone as shown on a diagram and/or normal X-ray, CT and MRI
- ii. Name, structure and function of joint types and muscle and ligament attachments that surround the joints and the ranges of motion allowed by each type (e.g., ball and socket)
- iii. Structures of bones in cross-section
- iv. Cellular composition, structure and function of bones, bone marrow and cartilage
- v. Development and maturation of bones at the cellular and gross anatomical levels
- vi. How to distinguish between types of vertebrae (e.g., cervical, thoracic and lumbar)
- vii. Characteristics and radiological features of bone diseases/disorders from the cell level to the whole person as listed: osteoarthritis, osteoporosis, fractures, disc herniation, scoliosis, anterior cruciate ligament tears, medial collateral ligament damage, **spinal fractures**
- viii. The effects of exercise and aging on the skeletal system and the diseases mentioned above
- ix. **Growth plate injuries - how they occur and the long-term effects**
- x. **National Tournament Only:**
 - (1) Additional diseases/disorders: spinal stenosis, achondroplasia, juvenile rheumatoid arthritis, ankylosing spondylitis, osteosarcoma, **Paget's disease, fibrous dysplasia, and osteogenesis imperfecta**
 - (2) Treatments and/or prevention for all conditions listed above (drugs, surgery, etc.)
 - (3) Label the bones of the skull. Know the foramina of the skull and what passes through each
 - (4) Salter-Harris fracture classification system

- c. **MUSCULAR SYSTEM:**

- i. The interaction of the skeletal and muscular systems to allow movement
- ii. Muscle fibers - the cellular and gross anatomy of skeletal muscle, cardiac muscle & smooth muscle
- iii. Physiology of the skeletal muscle contraction system and the neuromuscular junction
- iv. How the skeletal muscles move bone, maintain posture, and produce heat
- v. Skeletal muscle actions – origin, insertion, interactions of different muscles
- vi. **Cardiac and smooth muscle roles in the body**
- vii. Location and identification, including origin, insertion, and function, of the major skeletal muscles of the body listed on the **2021 Science Olympiad Major Skeletal Muscle List**



- viii. **The diseases on each level from cellular to the whole person: Muscular Dystrophy, Fibromyalgia, tendinitis, Cerebral palsy, Poliomyelitis, Myasthenia gravis, tetanus, myositis**
- ix. Exercise and aging effects on the cellular and gross anatomical structures of the muscular system
- x. Muscle and tendon injuries and their prevention (i.e., strains and sprains)
- xi. National Tournament Only:
 - (1) Kinds of muscle contraction
 - (2) Classes of muscle fibers and their functions
 - (3) Role of the nervous system in muscle function
 - (4) Muscle sensory systems (e.g., spindles and Golgi tendon organs)
 - (5) **Muscular system involvement in: respiration, digestion, circulation and stability**
 - (6) Additional diseases: Carpal Tunnel Syndrome, Botulism, and Chronic fatigue syndrome, **Marfan syndrome, myotonia, and rhabdomyolysis**
 - (7) Treatments and/or prevention for all conditions listed above (drugs, surgery, etc.)

4. **SCORING:**

- a. High score wins.
- b. Selected questions will be used to break ties.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Anatomy and Physiology CD and Bio/Earth Science CD; other resources are on the event page at soinc.org.

2021 Science Olympiad Major Skeletal Muscles

Head and Neck

Frontalis
 Orbicularis oris
 Orbicularis oculi
 Occipitofrontalis
 Zygomaticus major
 Masseter
 Sternocleidomastoid
 Trapezius
 Buccinator

Move the Upper Extremities

Pectoralis major
 Latissimus dorsi
 Deltoid
 Teres major
 Biceps brachii
 Triceps brachii
 Brachialis
 Brachioradialis
 Palmaris longus
 Flexor carpi radialis
 Flexor digitorum superficialis
 Extensor carpi radialis
 Extensor digitorum
 Extensor digiti minimi
 Extensor carpi ulnaris

Muscles of the Trunk

External Intercostals
 Internal Intercostals
 Transverse abdominis
 Infraspinalis
 Rectus abdominis
 Serratus anterior
 Diaphragm

Move the Lower Extremities

Iliopsoas
 Sartorius
 Gluteus maximus
 Gluteus medius
 Tensor fasciae latae
 Adductor longus
 Gracilis
 Semimembranosus
 Semitendinosus
 Biceps femoris
 Rectus femoris
 Vastus lateralis
Vastus intermedius
 Vastus medialis
 Tibialis anterior
 Gastrocnemius
 Soleus
 Peroneus longus
 Peroneus brevis



1. **DESCRIPTION:** Teams will design and build a Boomilever meeting requirements specified in these rules to achieve the highest structural efficiency.

A TEAM OF UP TO: 2 **IMPOUND:** NO **EYE PROTECTION:** B **EVENT TIME:** 6 minutes

2. **EVENT PARAMETERS:**

- a. Each team is allowed to enter only one Boomilever, built prior to the competition.
- b. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without proper eye protection will not be allowed to compete and be placed in Tier 3.
- c. Participants may NOT bring any equipment such as levels or squares.
- d. The Event Supervisor will provide the Test Apparatus (see Section 5) and tools/materials for measurement.

3. **CONSTRUCTION PARAMETERS:**

- a. The Boomilever must be a single structure with no separate, **loose, sliding**, or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
 - i. Wood is defined as the hard, fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include: bark, particleboard, wood composites, bamboo or grasses, paper, commercially laminated wood (i.e. plywood), or members formed of sawdust, **wood shavings**, and adhesive. Wood may never be painted, **soaked or coated in glue**, color enhanced, or have tape/preprinted/paper labels affixed. Ink barcodes or markings from the construction process may be left on the wood.
 - ii. There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
 - iii. Adhesive is a substance used to join two or more materials together and may be used only for this purpose. Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane, and super glues). Adhesive tapes are not allowed.
- b. The Boomilever must be designed to attach to the Testing Wall (5.a.) using the Mounting Hook.
- c. The Boomilever must be designed to support the Loading Assembly (5.b.) so that the loading point (the centerline of the chain) is between 40 cm and 45 cm from the Testing Wall.
- d. Before and throughout loading, no portion of the Boomilever may touch the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.).
- e. Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

4. **THE COMPETITION:**

Part I: Check-In

- a. The team must present their Boomilever for inspection & measurement.
- b. The team must place their Boomilever on the scale so the Event Supervisor can determine the mass, in grams to the nearest 0.01 g or best precision available.
- c. The team must submit their Estimated Load Supported (4.Part II.h.) to be used as a tiebreaker.
- d. No alterations, substitutions, or repairs may be made to the Boomilever after the check-in process has started.
- e. Prior to Part II: Testing, the Event Supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g, but no more than 15,200 g.

Part II: Testing

- a. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
- b. Participants will have 6 minutes to setup and test their Boomilever to maximum load or failure.
- c. The participants must place the Boomilever on the Testing Wall and assemble the Loading Assembly as required to load the Boomilever. If necessary, participants may disassemble & reassemble the Loading Assembly but must not adjust the Mounting Hook. **If the Loading Assembly is disassembled & reassembled it must retain the original sequence with no loose pieces and the opposing force must always be on the bottom of the Loading Block.** The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Boomilever to deflect.



- d. The participants will be allowed to adjust the Boomilever until they start loading sand. Once loading of sand has begun, the Boomilever must not be further adjusted.
 - e. Prior to loading, the Event Supervisor will verify that the Boomilever is placed properly:
 - i. Only attached to the Testing Wall by the Mounting Hook. **This attachment must be a pulling force on the inside radius of the J-bolt. The Boomilever may not thrust back against the wall during loading.**
 - ii. The loading point (3.c.) is between 40 cm and 45 cm from the Testing Wall as measured horizontally to the centerline of the chain (5.a.iv.).
 - iii. No portion of the Boomilever touches the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line.
 - f. Participants will load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by participants is NOT allowed. The bucket may only be stabilized by using the tips of the provided Bucket Stabilizing Sticks (5.d.).
 - g. Loading stops immediately when the Boomilever touches the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.), failure occurs, or time expires. Failure is defined as the inability of the Boomilever to carry any additional load, or if any part of the load is supported by anything other than the Boomilever. Incidental contact of the chain/eyebolt with the Boomilever is not failure.
 - h. Once loading stops, any parts of the Boomilever in the bucket will be removed. The Load Supported (mass of the Loading Assembly and the sand in the bucket) will be recorded to the nearest gram or best precision available. The minimum Load Supported is the mass of the Loading Assembly. The maximum Load Supported is 15,000 g.
 - i. At the Event Supervisor's discretion, more than one Test Apparatus may be used. Teams may be given a choice of which apparatus they will use.
 - j. The Event Supervisor will review with the team the data recorded on their scoresheet.
 - k. Teams who wish to file an appeal must leave their Boomilever with the Event Supervisor.
5. **TEST APPARATUS:**
- a. The Testing Wall must be as follows:
 - i. Vertical, solid, and rigid surface at least 40.0 cm wide x 30.0 cm high. Constructed of $\frac{3}{4}$ " grade plywood or other suitable material, with a smooth, hard, low friction surface that does not bend when loaded.
 - ii. The Mounting Hook must be a 4" steel J-bolt made of $\frac{1}{4}$ " nominal round stock, have a $\frac{5}{8}$ " nominal inside hook diameter with a threaded $\frac{1}{4}$ " mounting end [e.g., National Hardware barcode stock number N232-892 (UPC 038613228917), $\frac{1}{4}$ " by 4" or exact equivalent shall be used].
 - iii. The Mounting Hook must be attached to the Testing Wall by the Event Supervisor with the "opening" up and installed to allow 2.5 cm +/- 0.1 cm clearance between the wall and the closest edge of the Hook. The Hook must be secured in place with a hex nut and flat washer on the front side and a wing nut and flat washer on the back side of the Testing Wall. The Hook must be approximately 5.0 cm below the top of the Testing Wall and halfway between the sides. **The hex nut and washer on the front side of the Testing Wall are considered part of the Testing Wall.** The horizontal and vertical centerlines of the hole must be marked on the face of the Testing Wall.
 - iv. A horizontal Contact Depth Line must be clearly visible on the Testing Wall. It must be drawn 20 cm for Division B or 15 cm for Division C below the center of the hole for the Mounting Hook.
 - v. Two vertical Contact Width Lines must be clearly visible on the Testing Wall. They will be drawn 4.0 cm to the right and left side of the center of the hole for the Mounting Hook, **from the top of the Testing Wall to the horizontal Contact Depth Line.**
 - b. The Loading Assembly will consist of:
 - i. A square Loading Block measuring 5 cm x 5 cm x approximately 2 cm high with a hole no larger than 8 mm drilled in the center of the 5 cm x 5 cm faces for a $\frac{1}{4}$ " threaded eyebolt
 - ii. $\frac{1}{4}$ " threaded eyebolt (1" nominal eye outside diameter), minimum $2\frac{1}{4}$ " length to a maximum $4\frac{1}{2}$ " length, and a $\frac{1}{4}$ " wing nut. **The loading block must be mounted on the eye bolt and be trapped between the "eye" of the eye bolt and the wing nut. The loading block cannot sit on top of the wing nut or be loose.**



- iii. A chain and S-hook that are suspended from the eyebolt on the Loading Block
 - iv. An approximately five-gallon plastic bucket with handle and hook to be suspended from the chain
 - v. The total combined mass of the Loading Assembly may not exceed 1.5 kg
 - c. Sand: sand or other clean, dry free-flowing material.
 - d. Two (2) Bucket Stabilizing Sticks each made from a piece of ½" dowel approximately 18 inches long with a spring-type door stop screwed into one end. Refer to example on www.soinc.org.
6. **SCORING:**
- a. High score wins. Score = Load Score (g)/Mass of Boomilever (g).
 - b. The Load Score = Load Supported (4.Part II.h) + Bonus.
 - c. Boomilevers that have a Load Supported of 15,000 g will earn a Bonus of 5,000 g.
 - d. Boomilevers will be placed in three tiers as follows:
 - i. Tier 1: Holding any load and meeting all construction parameters and competition requirements
 - ii. Tier 2: Holding any load with any violations of the construction parameters and/or competition requirements
 - iii. Tier 3: Unable to be loaded for any reason (e.g., cannot accommodate or hold Loading Assembly, failure to wear eye protection) and will be ranked by lowest mass
 - e. Ties are broken as follows:
 - i. Estimated Load Supported closest to, without exceeding, the actual Load Supported
 - ii. Lowest Boomilever mass
 - f. Example score calculations:
 - i. Boomilever 1: mass = 10.12 g, Load Supported = 12,134 g; Score = 1,199
 - ii. Boomilever 2: mass = 12.32 g, Load Supported = 15,000 g + Bonus = 5,000 g = 20,000 g; Score = 1,623

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Boomilever Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

This event is sponsored by ArcelorMittal



1. **DESCRIPTION:** Participants must complete tasks and answer questions about electricity and magnetism.

A TEAM OF UP TO: 2

EYE PROTECTION: None

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during **any part** of the event.
- b. Each team may also bring writing utensils and two stand-alone calculators of any type for use during any part of the event.
- c. Event Supervisors must provide any material & measurement devices required for the hands-on tasks.
- d. Participants may bring their own basic multimeters for use in place of provided ones at the discretion of the Event Supervisor.

3. **THE COMPETITION:**

Part I: Written Test

- a. The written test consisting of multiple choice, true-false, completion, or calculation questions/problems will assess the team's knowledge of electricity and magnetism.
- b. Unless otherwise requested, answers must be in metric units with appropriate significant figures.
- c. The test will consist of at least one question from each of the following areas:
 - i. Historical perspective of the electricity discoveries made by Ampere, Coulomb, Kirchoff, Volta, Ohm, Tesla, & Faraday
 - ii. Properties of electric charges/fields, sources/hazards of static electricity, Coulomb's Law, capacitance
 - iii. Direct current (DC) characteristics, sources, uses, simple circuit diagrams, DC hazards
 - iv. Alternating current (AC) characteristics, sources, uses, AC hazards
 - v. Concepts and units of current, voltage, resistance, power, energy, and using Ohm's law
 - vi. Magnetic poles/fields, electromagnets, transformers, motors/generators, right-hand rule
 - vii. Electrical control devices including 3-way light switch circuits
 - viii. Simple calculations, constructions, and configurations of a circuit and individual components
 - ix. Fundamental characteristics and operation of a light emitting diode (LED)
 - x. Simple circuit analysis using Kirchoff's Voltage & Current Laws
 - xi. Division C only - Basic digital logic and digital logic operations
 - xii. Division C only - Basic electrical characteristics of silicon PN junctions (e.g., Diodes, PNP, NPN)
 - xiii. Division C only - Basics and applications of Operational Amplifiers (OpAmps)
- d. Topics not included in the competition are: semiconductors (beyond those listed above), AC circuit theory, inductance, calculations involving direct use of calculus and/or differential equations, non-linear devices, three-state logic gates, sequential logic, 3 Phase Power, and oscilloscopes.

Part II: Hands-On Tasks

- a. The hands-on portion will consist of at least one task at a station(s) for the teams to complete.
- b. Participants must be familiar with the operation of breadboards and how to use them. **Participants may ask event supervisors for details of the internal wiring of any breadboards used for the tasks.**
- c. The hands-on tasks, or stations, may include but are not limited to:
 - i. Determine the value of a mystery resistor in a circuit using only voltage measurements.
 - ii. Calculate the power supplied to a circuit.
 - iii. Given some wires, batteries, resistors, and 2 LEDs, hook them up so the LEDs are equally bright.
 - iv. Construct an electromagnet using some wire, a bolt and battery.

4. **SCORING:**

- a. High score wins.
- b. Points will be awarded for correct answers, measurements, calculations, and data analysis. Supervisors are encouraged to provide a standard form for competitors to show measurements/calculations.
- c. The written portion of the competition will account for 50-75% of each team's score. No single question will count for more than 10% of the total points possible on the written test.
- d. The hands-on portion of the competition will account for the remaining 25-50% of each team's score.
- e. Ties will be broken using pre-selected task(s)/question(s) that will be noted on the written test.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Chem/Phy Science CD; other resources are on the event page at soinc.org.

This event is sponsored by Institute of Electrical and Electronics Engineers (IEEE)



1. **DESCRIPTION:** 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.

A TEAM OF UP TO: 2 **EYE PROTECTION:** C **APPROXIMATE TIME:** 50 minutes

2. **EVENT PARAMETERS:**

- Each participant may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed.
- Each team may bring any or all of the items listed as Recommended Lab Equipment for Division B Chemistry Events, posted on soinc.org. Teams not bringing these items will be at a disadvantage. The Supervisor will not provide them.
- Teams may bring only specified items. Other items not listed, including calculators, are prohibited. The Event Supervisors will check each team's equipment, confiscate non-allowed items, and have the right to penalize the team up to 10% if additional equipment is brought to the event.
- Participants must wear goggles, an apron or a lab coat and have skin covered from the neck down to the wrist and toes. Gloves are optional, but if the host requires a specific type they will notify teams. Pants should be loose fitting; if the host has more specific guidelines they will notify teams in advance of the tournament. Shoulder length or longer hair must be tied back. Participants removing safety clothing/goggles or unsafely handling materials or equipment will be penalized or disqualified.
- The Supervisor will provide:
 - Iodine reagent (KI solution)
 - 1M HCl
 - Chromatography materials plus containers
 - Waste container(s)
 - Wash bottle with distilled water (no more than 250 mL)
- The Supervisor may provide:
 - Other equipment (e.g., microscope, probes, calculator, etc.)
 - Candle & matches if fibers given
 - Differential density solutions or other method of determining density of polymers if plastics given
 - Reagents to perform additional tests

3. **THE COMPETITION:**

- The competition will consist of evidence from Parts 3.c.-f. and analysis of the evidence in Part 3.g. Analysis or questions can only be on the evidence topics included in the competition. The amount of evidence included will be according to the following table:

Level	Part 3.c. (i-iii)	Limit on Mixtures from Part 3.c.i. only	Part 3.d.	Part 3.e.	Part 3.f.	Part 3.g.
Regional	6-15	Up to 2 of 2 solids with *	5-7	1 type	1-2 topics	Required
State	10-18	2-4 of 2-3 solids with *	7-10	1-2 types	2-3 topics	Required
National	14-20	2-6 of 2-3 solids with *	10-15	1-3 types	2-4 topics	Required

- The collected evidence and other data given may be used in a mock crime scene.
- Qualitative Analysis: Participants will identify evidence (unknowns) by performing tests such as solubility, acidity, magnetic property, color, density, and odor. Every team will have the same set of unknowns (evidence). The scenario will identify which containers hold mixtures and if the mixtures are made of two or three materials. The unknown common materials will be taken from the following lists.
 - Solids: Anhydrous sodium acetate, yeast, vitamin C (ascorbic acid), *calcium carbonate (powdered limestone), *table salt (NaCl), *sugar (crystal), *flour, *calcium sulfate **dihydrate** (gypsum), *cornstarch, *baking soda, *powdered gelatin, *powdered Alka-Seltzer®, *sand (white).
 - Non-Powdered Metals: aluminum, iron, zinc, magnesium, copper, tin.
 - Liquids: lemon juice, rubbing alcohol (isopropyl), household ammonia (3%), water, vinegar, hydrogen peroxide (3%).



- d. Polymer Testing/Natural and Man-made Substances: Participants will demonstrate their skill in analyzing evidence from a variety of sources such as:
- Hair - the difference between human, dog, and cat; not specific kinds of hair.
 - Fibers - the difference between animal, vegetable, and synthetic; not specific kinds of fibers.
 - Recyclable Plastics - PETE, HDPE, non-expanded PS, LDPE, PP, PVC, PMMA. Burn tests will not be conducted but burn results may be provided.
- e. Paper Chromatography: Participants will analyze evidence from paper chromatography (ink pens, juices, Kool-Aid®, etc.). The paper chromatogram(s) will be collected with the score sheet. No calculations are expected to be performed.
- f. Crime Scene Physical Evidence: Participants will also demonstrate their skill in analyzing evidence from a variety of other sources such as:
- Fingerprints: Participants may be asked to identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
 - DNA evidence: Participants may be asked to compare DNA chromatograms/electropherograms from materials found at the scene to those of the suspects.
 - Shoeprints & tire treads: Participants may be asked to compare prints and make conclusions such as direction and speed of travel. No calculations are expected to be performed.
 - Soil: Participants may be given the composition of soil found at the scene or on the suspects and asked to determine if this implicates any of the suspects.
 - Spatters: Analyze spatter patterns for speed and direction of impact. No calculations are expected to be performed.
- g. Analysis: Participants will be asked to write an analysis of the crime scene explaining not only which pieces of evidence implicate which suspect and why the suspect(s) was (were) chosen as the culprit(s), but also why the other suspects were not chosen. They will also answer any other crime scene analysis questions posed by the Event Supervisor.
- h. Teams will dispose of waste as directed by the Event Supervisor.
4. **SCORING:**
- The team with the highest score wins. Time will not be used for scoring.
 - The score will be composed of the following elements (percentages given are approximate):
 - 3.c. = 50%
 - 3.d. = 10%
 - 3.e. = 5%
 - 3.f. = 10%
 - 3.g. = 25%
 - Actual point values will be shown at each question.
 - The tiebreakers in order are the score from:
 - Part 3.g.
 - Part 3.c.
 - Part 3.d.
 - A penalty of up to 10% may be given if the area is not cleaned up as instructed by the Event Supervisor.
 - A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.
- Recommended Resources:** The Science Olympiad Store (store.soinc.org) carries the Science Crime Busters CD and Science Crime Busters Manual; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Participants compete in activities and answer questions about mass, density, number density, area density, concentration, pressure, and buoyancy.

A TEAM OF UP TO: 2

EYE PROTECTION: B

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during **any part** of the event.
- Each team may also bring writing utensils, and two stand-alone calculators of any type for use during any part of the event.
- Event Supervisors will provide any material and measurement devices required for the hands-on tasks. Teams will not use their own measurement devices.

3. **THE COMPETITION:**

Part I: Written Test

- The written test consisting of multiple choice, true-false, completion, or calculation questions/problems will assess the team's knowledge of mass, density, number density, area density, concentration, temperature, pressure, and buoyancy.
- The test will not include questions requiring non-adiabatic process calculations or assumptions.
- Unless otherwise requested, answers must be in metric units with appropriate significant figures.
- The test will consist of at least one question from each of the following areas:
 - Density of solids, liquids, and gases
 - Determination of concentrations limited to: mass/mass, mass/volume, volume/volume percentages, parts per million (ppm), and parts per billion (ppb)
 - Behavior of gases according to the gas laws: Ideal Gas, Boyle's, Charles', Gay-Lussac's, and Avogadro's
 - Archimedes' Principle

Part II: Hands-On Tasks

- The hands-on portion of the competition will consist of at least one task at a station(s) for the teams to complete.
- Tasks, or stations, will relate to the above content and may include but are not limited to:
 - For a given container of gas, measure its volume and mass, and calculate the mass density.
 - Given a small bag of Skittles, determine the number density of the green Skittles in the bag.
 - Given a helium balloon and a balance determine the mass that the balloon could theoretically lift.
 - Determine the depth to which a solid object will sink when placed in water.
 - Determine the density of a material at different temperatures (e.g., air or water).

4. **SCORING:**

- High score wins.
- The written portion of the competition will account for 50% or less of each team's score. No single question will count for more than 10% of the total points possible on the written test.
- The hands-on portion of the competition will account for at least 50% of each team's score.
- Points will be awarded for correct answers, measurements, calculations, and data analysis. Supervisors are encouraged to provide a standard form for competitors to show measurements/calculations.
- Ties will be broken using pre-selected task(s)/question(s) that will be noted on the written test.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Density Lab Video Download and Chem/Phy Science CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Participants will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

Each team may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed along with two stand-alone non-programmable, non-graphing calculators.

3. **THE COMPETITION:**

This event has been reorganized into three parts with each part counting approximately equally towards a team's final score.

Part I: Background & Surveillance

- a. Understand the Clinical Approach (health of individuals) and Public Health Approach (health of populations)
- b. Understand the roles of epidemiology in public health and the steps in solving health problems
- c. Understand the Natural History and Spectrum of Disease and the Chain of Infection
- d. Understand basic epidemiological and public health terms (e.g., outbreak, epidemic, pandemic, surveillance, risk, vector, etc.)
- e. Understand the role of Surveillance in identifying health problems, the 5 step Process for Surveillance and the types of surveillance

Part II: Outbreak Investigation

- a. Analyze an actual or hypothetical outbreak
- b. Understand the Types of Epidemiological Studies – Experimental and Observational
- c. Be able to identify the Steps in an Outbreak Investigation
- d. Identify the problem using person, place, and time triad – formulate case definition
- e. Interpret epi curves, line listings, cluster maps, and subdivided tables
- f. Generate hypotheses using agent, host, environment triad
- g. Recognize various fundamental study designs and which is appropriate for this outbreak
- h. Evaluate the data by calculating and comparing simple rates and proportions as attack rate, relative risk, odds-ratio and explaining their meaning
- i. Apply the Bradford Hill Criteria for Verifying the Cause of this outbreak
- j. **Division C Only:** Recognize factors such as study design/biases, errors, confounding that influence results
- k. **Division C - Nationals Only:** Suggest types of control & prevention measures for this outbreak

Part III: Patterns, Control, and Prevention

- a. Identify patterns, trends of epidemiologic data in charts, tables and graphs.
- b. Using given data, calculate disease risk and frequency ratio, proportion, incidence proportion (attack rate), incidence rate, prevalence and mortality rate
- c. Understand the Strategies of Disease Control
- d. Understand Strategies for Prevention-the Scope and Levels of Prevention
- e. **Division C Only:** Propose a reasonable set of prevention strategies for a public health problem once the cause has been determined
- f. **Division C - Nationals Only:** Identify the strengths and weaknesses of a set of proposed prevention strategies

4. **SCORING:**

- a. High score wins. Selected questions may be used as tiebreakers.
- b. Points will be assigned to the various questions and problems. Both the nature of the questions and scoring will emphasize an understanding that is broad and basic rather than detailed and advanced.
- c. Depending on the problem, scoring may be based on a combination of answers, including graphs/charts, explanations, analysis, calculations, and closed-ended responses to specific questions.
- d. Points will be awarded for both quality and accuracy of answers, the quality of supporting reasoning, and the use of proper scientific methods.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Disease Detectives CD and Bio/Earth Science CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Teams will complete tasks related to physical and geological oceanography.
A TEAM OF UP TO: 2 **APPROXIMATE TIME: 50 minutes**
2. **EVENT PARAMETERS:**
 - a. Each team may bring one 2" or smaller three-ring binder, as measured by the interior diameter of the rings, containing information in any form and from any source. Sheet protectors, lamination, tabs, and labels are permitted. If the event features a rotation through a series of laboratory stations where the participants interact with samples, specimens, or displays; no material may be removed from the binder throughout the event.
 - b. Each team may bring two stand-alone calculators of any type.
3. **THE COMPETITION:**
 - a. Participants will be presented with questions which may include one or more tasks at a workstation or a timed station-to-station format.
 - b. The participants will be expected to use process skills (e.g., communicating, classifying, inferring, measuring, observing, predicting, and using number relationships) to answer questions on the following topics:
 - i. Seawater: composition, density, variations in salinity, and sources of salts
 - ii. Shortwave and longwave radiation, sensible and latent heat fluxes, geothermal heat, and heat transport
 - iii. Water temperature, pressure, and the three-layer structure of ocean water
 - iv. Topographic features found at continental margins, estuaries, ocean basins, and mid-ocean ridges
 - v. Processes and features of tectonic plate motion in ocean basins and patterns of age of the ocean floor
 - vi. Distribution of chemicals (e.g., nutrients, oxygen, metals) in the ocean, as well as vertical and horizontal structure
 - vii. Formation of fringing reefs, barrier reefs, and atolls
 - viii. Waves: Motion, height, wavelength, period, fetch, swell, surf, and tsunamis
 - ix. Surface currents: Warm and cold currents, Coriolis effect, and gyres
 - x. **Division C Only:** Ekman and geostrophic balances
 - xi. Coastal currents: longshore currents, rip currents, and upwelling
 - xii. Deep ocean circulation, ocean overturning, and water masses
 - xiii. High and low tides, spring and neap tides, tidal currents, and tidal resonance
 - xiv. Coastal features and processes, uplift and subsidence, and influence on sea level rise
 - xv. Oceanic tools used for research (e.g., collection of water samples, sediments, cores, and tracking water movement)
 - xvi. Relationships between fisheries and ocean circulation (e.g., upwelling, El Niño, Pacific Decadal Oscillation)
4. **REPRESENTATIVE ACTIVITIES:**
 - a. Given the water temperatures at various depths in a column of seawater, teams will construct graphs to identify and label the thermocline.
 - b. Use a downloaded dataset of oxygen to identify water masses and pathways of circulation.
 - c. Identify topographic features of ocean regions using seafloor maps.
 - d. Write a hypothesis to explain changes in water salinity in high latitude ocean regions.
 - e. Analyze and interpret water pH data from selected regions where barrier reef formation is changing.
 - f. Given a set of vertical profiles of salinity in an estuary, identify the type of estuary (e.g., fjord, salt wedge, well-mixed, partially-mixed) and discuss implications for bottom water hypoxia.
 - g. Relate trends in coastal flooding at specific locations to global sea level rise and local subsidence.
5. **SCORING:** Points will be awarded for the quality and accuracy of responses. High score wins. Ties will be broken by the accuracy and/or quality of answers to selected questions.
Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Dynamic Planet and Bio/Earth Science CDs; other resources are on the event page at soinc.org.

This event is sponsored by National Oceanic and Atmospheric Administration (NOAA)



- DESCRIPTION:** Prior to the tournament teams design, construct, and test elastic-launched gliders to achieve the maximum time aloft.

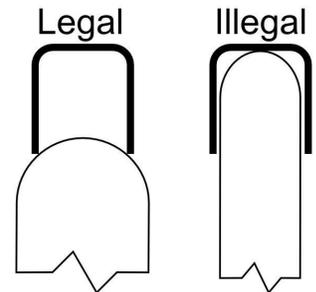
A TEAM OF UP TO: 2 EYE PROTECTION: B IMPOUND: No APPROXIMATE TIME: 6 minutes

2. **EVENT PARAMETERS:**

- Teams may bring up to 2 gliders for final inspection, flight log(s), any tools, and two stand-alone calculators of any type.
- Participants must wear eye protection. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows.
- Event Supervisors will provide all measurement tools and timing devices.

3. **CONSTRUCTION PARAMETERS:**

- Gliders may be constructed from published plan(s), commercial kits and/or student designs.
- Participants must not use any components with pre-glued joints or pre-covered surfaces.
- The glider must be constructed from only the following types of materials: wood, foam, paper, plastic film, carbon fiber, tape, thread, glue, and/or ballast. The ballast may be any malleable non-metallic substance.
- The functional components may be attached to each other using tape, thread and/or glue.
- The mass of the glider throughout the flight must be more than 3.0 g and less than 10.0 g.
- Wingspan must not exceed 28 cm at any time.
- The blunt nose of the fuselage, when inserted into a lip balm cap with inside dimensions of ~1.57 cm deep and ~1.37 cm wide must not touch the end.
- Launch handle(s), excluding elastic, must be less than 1 m long in any orientation, be supported completely by the students, and be of a safe configuration. The elastic used in the launch handle must be non-metallic and must be in contact with the glider throughout the launch. Elastic must remain on the launch handle. If elastic leaves the launcher, timing will end for that flight.
- Each glider must be labeled so the Event Supervisor can easily identify the team to which it belongs.
- Teams who build their glider in a canard configuration, where a smaller fore wing or horizontal stabilizer is placed in front of the main or larger wing and there is no rear horizontal stabilizer, will be eligible for a bonus to their single flight score. See SCORING (5.d.) for more details.



4. **THE COMPETITION:**

- The event must be held indoors. Tournament officials must announce the room dimensions (approximate length, width and ceiling height) in advance of the competition. Tournament officials and the Event Supervisor are urged to minimize the effects of environmental factors such as air currents.
- Once participants enter the cordoned off competition area to trim, practice, or compete they must wear eye protection at all times and not receive outside assistance, materials, or communication. Teams violating these rules must be ranked below all other teams. Spectators must be in a separate area.
- During inspection each team must present a flight log of recorded data. Data must include 4 or more parameters (3 required and at least 1 additional) for 10 or more test flights prior to the competition. The required parameters are: 1) estimated/recorded peak flight height after launch, 2) approximate length of elastic (relaxed), and 3) flight time. The team must choose an additional parameter beyond those required (e.g., orbit diameter, cross section of elastic launch loop, height at transition to glide pattern, launch angle, etc.).
- At the Event Supervisor's discretion:
 - multiple official flights may occur simultaneously;
 - test flights may occur throughout the contest but must yield to any official flight; and,
 - no test flights will occur in the final half-hour of the event's last period, except for teams that declare a trim flight during their 5-minute flight period.
- A self-check inspection station may be made available to participants for checking their glider and launch handle dimensions prior to being measured by the officials.
- Participants must present their glider(s), launch handle(s), and flight log for inspection immediately prior to their 5 official flights. Event Supervisors will return flight logs after inspection. Timers will follow teams as they prepare and launch their gliders.



- g. Gliders must be launched from a launch handle by a single participant who must be at floor level.
 - h. Teams may make up to a total of 5 official flights using 1 or 2 gliders.
 - i. After check-in teams must be given a 5-minute flight period, starting when their first flight (trim or official) begins. Any flight beginning within the 5-minute period must be permitted to fly to completion. Participants may make any adjustments/repairs/trim flights and may switch gliders or launch handles during their 5-minute Flight Period.
 - j. Gliders will be placed on the ground at the location where the participants choose to make their first flight. Once a team picks up their glider the team will have 1 minute to launch their first flight (trim or official). Time taken in the Preflight Period will impact a team's final score (see 5.b.). If 1 minute passes without the first flight (trim or official) having taken place the 5-minute flight period will begin and no Bonus will be awarded.
 - k. Participants must declare to the Timers before any launches during their Flight Period whether it is an official flight or trim flight. If teams do not indicate the flight type before the launch, it must be considered official. Teams must not be given extra time to recover or repair their gliders.
 - l. Time Aloft for each flight starts when the glider leaves the launch handle and stops when any part of the glider touches the floor, stops moving due to an obstruction (such as a glider landing on a girder or basketball hoop), or the Event Supervisor(s) otherwise determine the flight to be over.
 - m. Event Supervisors are strongly encouraged to utilize 3 Timers on all flights. The middle value of the 3 Timers must be the official Time Aloft for that flight, recorded in seconds to the precision of the device used.
 - n. Gliders must only be launched while aimed at any point on the ceiling. Participants must not aim for the walls, spectators, low obstructions, etc.
 - o. Participants must not steer their gliders during the flight.
 - p. In the unlikely event of a collision with another glider, a team may elect a re-flight. The decision to re-fly may be made after the glider lands. Timers are allowed to delay a launch to avoid a possible collision. The 5-minute period does not apply to such situations.
 - q. Teams filing an appeal must leave their glider(s) and flight log(s) in the event area.
5. **SCORING:**
- a. A Team's Score is the sum of their three longest Times Aloft (Accumulated Flight Score) after multipliers are applied. High Score wins.
 - b. Bonus: Once a team picks up their glider (4.j.) a timing official will start a Preflight Period stopwatch. If their first flight, trim or official, is launched within 1 minute, teams will earn a 1.10 multiplier to their overall Accumulated Flight Score. If they fail to launch within 1 minute, the 5-minute Flight Period will start and no bonus will be awarded.
 - c. Bonus: Any official glider's fuselage that can straddle a 32 cm (longer than 32.0 cm) opening with the overall length of the fuselage will earn a 1.10 multiplier for each flight where the glider is used.
 - d. Bonus: A single flight score will be multiplied by a factor of 1.25 for each flight of a Glider flying in a canard configuration. The canard configuration is where a smaller fore wing or horizontal stabilizer is placed in front of the main or larger wing, there is no rear horizontal stabilizer.
 - e. Teams with incomplete flight logs must have 10% deducted from their Final Score.
 - f. Teams without flight logs must have 30% deducted from their Final Score.
 - g. Teams with Construction or Competition violations must be ranked after all teams that do not violate those rules.
 - h. Ties must be broken by the longest non-scored Time Aloft.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Elastic Launched Glider Video and Problem Solving/Technology CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** This event will determine the participant's ability to design, conduct, and report the findings of an experiment entirely on-site.

A TEAM OF UP TO: 3

EYE PROTECTION: C

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Participants must bring goggles and writing utensils. Experiments will not require any other safety equipment.
- Division B teams may bring one timepiece, one linear measuring device, and one stand-alone non-programmable non-graphing calculator.
- Division C teams may bring one timepiece, one linear measuring device, and one stand-alone calculator of any type.
- The Event Supervisor will provide each team with identical sets of materials either at a distribution center or in an individual container.
- The Event Supervisor will supply a report packet, based on the Experimental Design Checklist, posted on the event page at soinc.org, for recording their experimental information and data.

3. **THE COMPETITION:**

- The teams must design, conduct, and report the findings of an experiment conducted on site that addresses the assigned question/topic area provided by the Event Supervisor. The assigned question/topic area should be the same for all teams and allow the participants to conduct experiments involving relationships between independent and dependent variables (i.e., height vs. distance).
- During the first 20 minutes of the event, participants will receive the assigned question/topic area, materials, and Part I of the report packet. Participants will focus on designing and conducting their experiment.
- After the first 20 minutes, participants will receive Part II of the report packet and will focus on analyzing their experiment and reporting findings. Participants may continue experimenting throughout the entire event.
- Each team must use at least two of the provided materials to design and conduct an experiment. The materials will be listed on the board or placed on a card for each team. If provided, both the card and the container will be considered part of the materials. The identity of the materials will be unknown until the start of the event.
- When a team finishes, all materials must be returned to the Event Supervisor including both parts of the report packet.

4. **SCORING:**

- High score wins. Scoring will be done using the Experimental Design Checklist found on the Science Olympiad website (soinc.org).
- Points will be awarded depending upon the completeness of the response. Zero points will be given for no responses as well as illegible or inappropriate responses.
- Ties will be broken by comparing the point totals in the scoring areas of the checklist in the following order:
 - J. Analysis of Claim/Evidence/Reasoning
 - E. Procedure and Set-Up Diagrams
 - C. Variables
 - G. Data Table
 - H. Graph
- Any participant not following proper safety procedures will be asked to leave the room and will be disqualified from the event.
- Any team not following clean-up procedures will have their final score multiplied by 0.95.
- Any team not addressing the assigned question/topic area will have their final score multiplied by 0.75.
- Any team not collecting data by conducting an experiment on-site will have their final score multiplied by 0.25.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Experimental Design CD and Problem Solving/Technology CD; other resources are on the event page at soinc.org



EXPERIMENTAL DESIGN CHECKLIST



See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

2021 Experimental Design Division B Checklist

(Note: The maximum points available for each task are shown.)

Part I – Design and Construction of the Experiment (58 pts)

A. Statement of the Problem (2 pts)

- ② ① ① **Statement addresses the experiment including variables (Not a yes/no question)**

B. Hypothesis (6 pts)

- ② ① ① **Statement predicts a relationship between the independent and dependent variables**
- ② ① ① **Statement gives specific direction to the prediction(s) (e.g., a stand is taken)**
- ② ① ① **A rationale is given for the hypothesis.**

C. Variables (16 pts)

a. Independent Variable (IV) (6 pts)

- ② ① ① **Correctly identified and defined**
- ④ ③ ② ① ① **Levels of IV given**

b. Dependent Variable (DV) (4 pts)

- ④ ③ ② ① ① **Correctly identified and defined**

c. Controlled Variables & Constant (CV) (6 pts)

- ② ① ① **First CV correctly identified**
- ② ① ① **Second CV correctly identified**
- ② ① ① **Constant correctly identified**

D. Materials (4 pts)

- ② ① ① **All materials are listed and quantified**
- ② ① ① **No extra materials are listed**

E. Procedure and Set-up Diagrams (14 pts)

- ② ① ① **Procedure is presented in list form**
- ② ① ① **Procedure is in a logical sequence**
- ② ① ① **Steps for repeated trials are included**
- ② ① ① **Multiple diagrams of setup are provided**
- ② ① ① **All diagrams are appropriately labeled**
- ④ ③ ② ① ① **Enough information is given so another could repeat procedure**

F. Qualitative Observations (6 pts)

- ② ① ① **Observations about procedure provided**
- ② ① ① **Observations about the results provided**
- ② ① ① **Observations given throughout the course of the experiment**

G. Quantitative Data - Data Table (10 pts)

- ② ① ① **All raw data is provided**
- ② ① ① **A condensed data table showing only the data to be graphed provided**
- ② ① ① **Tables and columns labeled properly**
- ② ① ① **All data has units**
- ② ① ① **Example calculations for derived variables are given**

Part II – Data, Analysis and Conclusions (66 pts)

H. Graph (12 pts)

- ④ ③ ② ① ① **Appropriate Graph is provided**
- ④ ③ ② ① ① **Graph properly titled and labeled**
- ④ ③ ② ① ① **Appropriate scale and units included**

I. Statistics (14 pts)

- ④ ③ ② ① ① **Statistics of Central Tendency (i.e., best fit, median, mode, mean)**
- ④ ③ ② ① ① **One example calculation is given for each statistic including units**
- ④ ③ ② ① ① **Statistics of Variation (i.e., min, max, range)**
- ② ① ① **Calculations are accurate**

J. Analysis of Claim/Evidence/Reason (CER) (18 pts)

- ② ① ① **Statistics Claim completed logically**
- ② ① ① **Statistics Evidence completed logically**
- ② ① ① **Statistics Reasoning completed logically**
- ② ① ① **Outliers Claim completed logically**
- ② ① ① **Outliers Evidence completed logically**
- ② ① ① **Outliers Reasoning completed logically**
- ② ① ① **Data Trend Claim completed logically**
- ② ① ① **Data Trend Evidence completed logically**
- ② ① ① **Data Trend Reasoning completed logically**

K. Possible Experimental Errors (8 pts)

- ④ ③ ② ① ① **One specific error is identified and effect on results discussed.**
- ④ ③ ② ① ① **Second specific error is identified and effect on results discussed.**

L. Conclusion (8 pts)

- ② ① ① **Hypothesis is re-stated**
- ② ① ① **Hypothesis Claim completed logically**
- ② ① ① **Hypothesis Evidence completed logically**
- ② ① ① **Hypothesis Reasoning completed logically**

M. Recommendations for Future Experimentation (6 pts)

- ② ① ① **Suggestions to improve the experiment are given**
- ② ① ① **Suggestions for practical applications of experiment are given**
- ② ① ① **Suggestions for future experiments are given**

School: _____ Team# _____

Point Total: _____/124

Deduction multiplier(s): _____
Non-clean up (0.95), Off topic (0.75), or Non-lab (0.25)

Final Score: _____



1. **DESCRIPTION:** Participants will answer questions on food chemistry with a focus on fermentation and pickling. In addition, participants will build a salinometer/hydrometer capable of measuring salt compositions between 1-10% (mass/volume).

A TEAM OF UP TO: 2

EYE PROTECTION: C

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each participant may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed along with writing utensils, and a stand-alone non-programmable, non-graphing calculator.
- Each team may bring any or all of the items listed as Recommended Lab Equipment for Division B Chemistry Events, posted on soinc.org. Teams not bringing these items will be at a disadvantage. The Supervisor will not provide them.
- Teams may bring only specified items. Other items not listed are prohibited. The Event Supervisors will check each team's equipment, confiscate non-allowed items, and have the right to penalize the team up to 10% if additional equipment is brought to the event.
- Each team must bring a participant-made salinometer/hydrometer capable of measuring salt concentrations between 1-10% (mass/volume). Any salinometer/hydrometer calibration data must be included on the 8.5" x 11" sheet(s) of paper mentioned in 2.a.
- Participants must wear goggles, an apron or a lab coat and have skin covered from the neck down to the wrist and toes. Gloves are optional, but if the host requires a specific type they will notify teams. Pants should be loose fitting; if the host has more specific guidelines they will notify teams in advance of the tournament. Shoulder length or longer hair must be tied back. Participants removing safety clothing/goggles or unsafely handling materials or equipment will be penalized or disqualified.
- The Event Supervisor will provide chemicals, foodstuff, a source of water and balances/equipment/materials to do laboratory activities.

3. **THE COMPETITION:**

Part I: Written/Lab Test

- The competition will consist of a written exam and/or lab activities covering the following topics:
 - types of fermented foods and pickles
 - food preservation processes
 - types of fermentation processes (aerobic respiration, homolactic fermentation, heterolactic fermentation, ethanol fermentation)
 - types of sugars & enzymes
 - citric acid cycle
 - standard of identity of acidified foods
 - nutrition labeling regulations
 - food safety of fermented and acidified vegetable products
 - health benefits of fermented foods
 - production of chemical feedstocks
 - yeast and bacteria identification and behaviors
 - water activity
 - density

Part II: Hands-On Testing

- Participants will be expected to perform at least one of the following tests at an Invitational or Regional Tournament, at least two of the tests at the State Tournament and all three of the tests at the National Tournament. The Event Supervisor for the tournament will decide which tests are conducted. All teams at the same tournament will perform the same test(s). The possible tests are:
 - Determine the salt content in 1-2 samples using the participant-made salinometer/hydrometer.
 - Determine the % moisture of a pickle.
 - Determine the pH of a pickle.
- Teams must build, calibrate, bring and demonstrate a salinometer/hydrometer capable of measuring saltwater (most likely NaCl) concentrations between 1-10% (mass/volume).
 - There are no restrictions on size except that the team must build the device to operate within a standard **400-600 mL** beaker filled with at least 400 mL of saltwater solution.



- ii. Teams will be expected to estimate the percent salinity measured by their device to the nearest tenth of a percent. Full credit will be given $\pm 1\%$ at Regionals and $\pm 0.5\%$ at State/Nationals. Calibration solutions may or may not be provided by the Event Supervisor.
- iii. A detailed rubric is available on the soinc.org website.

4. **SAMPLE ACTIVITIES AND QUESTIONS:**

- a. What bacteria are typically used to prepare Kombucha?
- b. Determine the moisture content in percentage of the provided pickles.
- c. Are all pickles fermented?
- d. Of the following Experimental setups of fermentation with balloons indicating carbon dioxide production, which flask has fructose?
- e. Which of the following microscopic images contain *Lactobacillus*?
- f. What is the purpose of fermentation in the production of chocolate?

5. **SCORING:**

- a. High score wins.
 - i. Part I counts for 60% of a team's overall score.
 - ii. In Part II, bringing a salinometer counts for 10% of the team's score. If one test is done, it counts for 30% of the team's score. If two tests are done they each count for 15% of the team's score. If all three tests are done, each count for 10% of the team's score.
- b. Time may be limited at each task but will not be used as a tiebreaker or for scoring.
- c. Ties will be broken by pre-selected questions from Part I.
- d. A penalty of up to 10% may be given if the area is not cleaned up as instructed.
- e. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

Recommended Resources: The Science Olympiad store (store.soinc.org) carries the Chem/Phy Sci CD (CPCD); other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Teams identify and classify fossils and demonstrate their knowledge of ancient life by completing tasks related to interpretation of past environments and ecosystems, adaptations and evolutionary relationships, and use of fossils in dating and correlating rock units.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Each team may bring one magnifying glass, the *Science Olympiad Official Fossil List* and one 2" or smaller three-ring binder, as measured by the interior diameter of the rings, containing information in any form and from any source. Sheet protectors, lamination, tabs and labels are permitted.
- b. If the event features a rotation through a series of laboratory stations where the participants interact with samples, specimens, or displays; no material may be removed from the binder.

3. **THE COMPETITION:**

- a. Participants will move from station to station, with the length of time at each station predetermined and announced by the Event Supervisor.
- b. Participants may not return to stations but may continue to work on their responses throughout.
- c. Stations will feature task-oriented activities emphasizing application of paleontological concepts.
- d. Identification will be limited to specimens on the *Science Olympiad Official Fossil List*, but other samples may be used to illustrate key concepts.
- e. Questions will be chosen from the following topics:
 - i. Identification of all fossil specimens on the *Science Olympiad Official Fossil List*
 - ii. Taxonomic classification restricted to the hierarchy on the *Science Olympiad Official Fossil List*
 - iii. Conditions required for a plant or an animal to become fossilized
 - iv. Common modes of preservation: petrification/petrifaction (e.g., permineralization & mineral replacement including silicification and pyritization), cast, external vs. internal molds (steinkerns), imprints, carbonization, unaltered remains
 - v. Uncommon modes of preservation: encasement in amber, mummification, freezing, tar
 - vi. Relative dating: law of superposition, original horizontality, cross-cutting relationships, unconformities
 - vii. Absolute dating: radiometric dating (i.e., Carbon 14 dating), including half-life, radioactive isotopes used, and use of igneous rocks and volcanic ash layers in absolute dating
 - viii. The Geologic Time Scale, its organization, major events, the 5 major mass extinctions, and the Pleistocene-Holocene extinction of megafauna. An official *Science Olympiad Geologic Time Scale* is posted at soinc.org & should be used for all competitions
 - ix. Index Fossils: characteristics and use in determining the age of rocks & geologic formations
 - x. Fossil-bearing sedimentary rocks: limestone, shale, sandstone, coquina, chert
 - xi. Modes of life: filter feeder, predator, scavenger, deposit feeder, benthic, pelagic
 - xii. Environments: shallow marine, reef, lagoon, deep marine, terrestrial, fresh water
 - xiii. Mineral and organic components of exoskeletons, shells, and bones/teeth (e.g., calcite, aragonite, silica, chitin, biological apatite)
 - xiv. Adaptations and morphologic features of major fossil groups
 - xv. Important paleontological discoveries (i.e., non-avian dinosaurs with feathers; transitional species such as *Tiktaalik* and *Archaeopteryx*)
 - xvi. *Lagerstätten* (conservation and concentration) and their significance, limited to: Burgess Shale, Beecher's Trilobite Bed, Mazon Creek, Ghost Ranch, Solnhofen Limestone, Yixian Formation (Liaoning), Green River Formation, and La Brea Tar Pits
 - xvii. Fossils as evidence for evolutionary trends and patterns such as morphological adaptations within groups, major evolutionary events and transitions (e.g., Cambrian Explosion, Mesozoic Marine Revolution, fish to tetrapods, dinosaurs to birds, whales, horses)
 - xviii. Trace fossils (ichnofossils) including, but not limited to trails, trackways, borings, burrows, tubes, predation marks, repair scars, and coprolites
 - xix. Stromatolites, how they form, and their role in the history of life and development of Earth's atmosphere

**4. SAMPLE QUESTIONS/TASKS:**

- a. Identify each fossil, record its mode of preservation, the type of rock the sample is embedded in, and the geologic period it represents.
- b. List samples in order from oldest to most recent.
- c. Based on the fossil and rock associations, determine the environment in which the organism lived.
- d. The fossils illustrated were discovered in the Solnhofen Limestone, a unique Lagerstätten in Germany. What geological period is indicated based on the specimens in this limestone?
- e. How can the occurrence of both marine and terrestrial animals in the Solnhofen Limestone be explained?
- f. Describe the evolutionary relationships between the organisms illustrated on the family tree (cladogram/phylogenetic tree).
- g. Construct a range chart and determine the age of the fossil assemblage.

5. SCORING:

- a. High score wins. Points will be awarded for the quality and accuracy of responses.
- b. Ties will be broken by the accuracy and/or quality of responses to several pre-identified questions.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Fossils CD, the Bio/Earth Science CD, and the *Smithsonian Handbooks: Fossils*; other resources are on the event page at soinc.org.



KINGDOM PROTOZOA

Phylum Foraminifera (Forams) *

- Order Fusulinida (Fusulinids)*
- Order Rotaliida*
- Genus *Nummulites**

KINGDOM ANIMALIA

SPONGES (Phylum Porifera)

- Genus *Astraeospongia* (calcareous sponge)
- Genus *Hydnoceras* (glass sponge)*

BRYOZOANS (Phylum Bryozoa)

- (Growth forms: branching, massive, fenestrate)
- Genus *Archimedes*
- Genus *Rhombopora*

GRAPTOLITES (Phylum Hemichordata)*

- Order Dendroidea (benthic graptolites)
- Order Graptoloidea (planktic graptolites)

CORALS (Phylum Cnidaria)

- Order Tabulata (tabulate corals)
 - Genus *Favosites*
 - Genus *Halysites**
- Order Rugosa (rugose corals)
 - Genus *Heliophyllum* (horn coral)
 - Genus *Hexagonaria*
- Order Scleractinia (stony corals)
 - Genus *Septastrea*

ARTHROPODS (Phylum Arthropoda)

- Subphylum Crustacea (shrimp, lobster, crabs, barnacles, ostracods)*
- Subphylum Chelicerata
 - Order Eurypterida (Eurypterids)
- Class Insecta (Insects)
- Class Trilobita (Trilobites)
 - Genus *Cryptolithus*
 - Genus *Calymene*
 - Genus *Elrathia*
 - Genus *Isotelus**
 - Genus *Eldredgeops* (formerly *Phacops*)

BRACHIOPODS (Phylum Brachiopoda)

- Class Inarticulata
 - Genus *Lingula*
- Class Articulata
 - Genus *Atrypa*
 - Genus *Composita*
 - Genus *Juresania**
 - Genus *Leptaena*
 - Genus *Mucrospirifer*
 - Genus *Platystrophia*
 - Genus *Rafinesquina*
 - Order Rhynchonellida

MOLLUSKS (Phylum Mollusca)

- Class Bivalvia (clams, oysters, mussels)
 - Genus *Exogyra*
 - Genus *Gryphaea*
 - Genus *Pecten*
 - Genus *Glycymeris*
 - Genus *Astarte*
 - Genus *Nucula*
- Class Cephalopoda
 - Order Goniatitida (goniatites)*
 - Order Ceratitida (ceratites)*
 - Order Ammonitida (ammonites)
 - Genus *Baculites*
 - Genus *Dactylioceras*
 - Order Belemnitida (Belemnites)
 - Genus *Belemnitella*
 - Order Nautilida (Chambered Nautilus)
 - Order Orthocerida ("Orthoceras")
- Class Gastropoda (Snails)
 - Genus *Conus*
 - Genus *Cypraea*
 - Genus *Platyceras*
 - Genus *Turritella*
 - Genus *Worthenia*

ECHINODERMS (Phylum Echinodermata)

- Class Asteroidea (Starfish)*
- Class Blastoidea
 - Genus *Pentremites*
- Class Crinoidea (stems, columns, calyxes)
- Class Echinoidea (regular or irregular echinoids including sea urchins, sand dollars and heart urchins)
- Class Ophiuroidea (brittle stars)*

VERTEBRATES (Phylum Chordata)

- Superclass Agnatha (Jawless Fish) (Ostracoderms)*
- Class Placodermi (Armored Jawed Fish)
 - Genus *Bothriolepis*
 - Genus *Dunkleosteus*
- Class Chondrichthyes (Cartilaginous Fish)
 - Superorder Selachimorpha (Sharks)
 - Genus *Otodus*
 - Genus *Carcharocles* (formerly *Carcharodon*)
 - Species *C. megalodon*
 - Superorder Batoidea (Rays)*
- Superclass Osteichthyes (Bony Fish)
 - Class Actinopterygii (ray-finned)
 - Genus *Knightia*
 - Genus *Xiphactinus**
 - Class Sarcopterygii (lobe-finned)
 - Genus *Eusthenopteron*
 - Genus *Latimeria* (Coelacanth)
 - Genus *Tiktaalik*



FOSSIL LIST (CONT.)

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.



Class Amphibia (Amphibians)

- Genus *Acanthostega*
- Genus *Eryops*
- Genus *Diplocaulus*

Class Reptilia (Reptiles)

- Order Crocodylia (crocodiles)*
- Order Testudines (turtles)*
- Order Ichthyosauria (Ichthyosaurs)
- Order Squamata
 - Family Mosasauridae (Mosasaurs)
- Order Plesiosauria (Plesiosaurs & Pliosaurus)
- Order Pterosauria (Pterosaurs)

Clade Dinosauria (Dinosaurs)

Order Saurischia (lizard-hipped)

- Suborder Theropoda
 - Genus *Allosaurus*
 - Genus *Coelophysis*
 - Genus *Dilophosaurus*
 - Genus *Spinosaurus**
 - Genus *Tyrannosaurus*
 - Genus *Velociraptor*

Suborder Sauropodomorpha

- Genus *Brachiosaurus*
- Genus *Diplodocus*
- Genus *Patagotitan**
- Genus *Plateosaurus*

Order Ornithischia (bird-hipped)

- Infraorder Ankylosauria
 - Genus *Ankylosaurus*
- Infraorder Ceratopsia
 - Genus *Triceratops*
 - Genus *Protoceratops**
- Infraorder Ornithopoda
 - Genus *Iguanodon*
 - Genus *Parasaurolophus*
 - Genus *Maiasaura*

Infraorder Pachycephalosauria

- Genus *Dracorex*

Infraorder Stegosauria

- Genus *Stegosaurus*

Class Aves (Birds)

- Genus *Archaeopteryx*
- Genus *Titanis* (Terror Bird)
- Genus *Ichthyornis**

Clade Synapsida

Mammal-like Reptiles

- Genus *Dimetrodon* (pelycosaurs)
- Genus *Lystrosaurus* (therapsids)

Class Mammalia (Mammals)

- Genus *Basilosaurus* (prehistoric whale)
- Genus *Equus* (modern horse)
- Genus *Australopithecus* (hominin)*
- Genus *Homo* (hominin)
 - Species *H. neanderthalensis*
 - Species *H. erectus**
 - Species *H. sapiens*
- Genus *Mammut* (Mastodon)
- Genus *Mammuthus* (Mammoth)
 - Species *M. primigenius*
 - (Woolly Mammoth)**
- Genus *Megacerops* (Brontothere)
- Genus *Meshippus* (three-toed horse)
- Genus *Smilodon* (saber-toothed cat)

KINGDOM PLANTAE

FLOWERING PLANTS (Phylum Anthophyta)

- Genus *Acer* (Maple)
- Genus *Populus* (Aspen & Poplar)
- Genus *Platanus* (Sycamore)

GINKGOS (Phylum Ginkgophyta)

- Genus *Ginkgo*

CLUB MOSSES (Phylum Lycopodiophyta)

- Genus *Lepidodendron* (scale tree)

CONIFERS (Phylum Pinophyta)

- Genus *Metasequoia*

HORSETAILS (Phylum Sphenophyta)

- Genus *Calamites* (form leaf genus: *Annularia*)

SEED FERNS (Phylum Pteridospermatophyta)

- Genus *Glossopteris*

TRUE FERNS (Phylum Pteridophyta)

- Genus *Psaronius* (form leaf genus: *Pecopteris*)

ADDITIONAL EARTH MATERIALS

Trace Fossils

- Trails, Tracks, Trackways,
- Borings, Burrows, Tubes
- Predation marks, Repair scars
- Coprolites

Stromatolites

Amber/copal

Petrified wood

Sedimentary Rocks

- Coquina
- Limestone (Chalk/Fossil limestone)
- Sandstone
- Shale
- Chert

Note: Taxa marked by an asterisk (*) are for State and National Tournaments only



1. **DESCRIPTION:** This event will determine a team's ability to design and build an original computer game using the program Scratch incorporating the scientific theme provided to them by the Supervisor.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Teams must bring a writing utensil(s) and may bring:
 - i. Headset(s), including audio port adapters, to assist in testing audio
 - ii. A microphone to assist in recording original audio
- b. No Internet access outside of the Scratch program is allowed. No external resources or computer programs of any kind are allowed. No pre-constructed games, game assets or files are allowed.
- c. Supervisors will provide:
 - i. A computer capable of running Scratch. Tournament Directors are encouraged to provide computer specifications to the teams as early as possible
 - ii. Scrap paper

3. **THE COMPETITION:**

- a. The Supervisor will assign the teams a broad scientific theme that the original computer game will be built around. The scientific theme must be the same for all teams and allow students to build games involving some scientific principles associated with the theme.
- b. Students will use the Scratch program (available for download from <http://scratch.mit.edu>) to create an original computer game based on the assigned scientific theme.
- c. When teams are finished, they must save their game following the Supervisor's instructions in the specified format in a designated location (i.e., USB drive, desktop, online repository).

4. **PRACTICE GAME THEMES:**

Some game themes that have been used in the past that are NOT intended for current tournament use: Wave, Fire, Gravity, Frogs, Newton's Second Law, Light.

5. **SCORING:**

- a. High score wins. Scoring of the event will be done using the Game On Rubric found on soinc.org.
- b. Points will be awarded based on the coding and/or game play of the items.
- c. Zero points will be awarded for items not being present in the game or inappropriate content.
- d. Any team caught using outside resources or accessing the internet outside of the Scratch program will be asked to leave the room and be disqualified from the event.
- e. Any team not addressing the assigned scientific theme in their game will have their final score multiplied by 0.67 because not addressing the theme is a violation of the spirit of the competition.
- f. Ties will be broken by comparing the point totals in the scoring areas in the following order:
 - i. Game Mechanics
 - ii. Game Play
 - iii. User Control
 - iv. Balanced Play
 - v. Overall Impression/Originality

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Game On Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

This event is sponsored by Code.org

HEREDITY



See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.



1. **DESCRIPTION:** Participants will solve problems and analyze data or diagrams using their knowledge of the basic principles of genetics.

A TEAM OF UPTO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

Each team may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed along with two stand-alone non-programmable, non-graphing calculators.

3. **THE COMPETITION:**

- This event may be run at stations and could include process skills such as data analysis, predictions, calculations, inferences, and observations.
- Participants will be given a combination of genetic problems to solve, pedigrees, karyotypes, or diagrams to analyze. Every attempt should be made to avoid over-emphasis on a particular area. Common genetic disorders will apply to all levels.
- At the various levels, possible areas to be tested are limited to the following topics:

Regional and State Tournament Topics		National Tournament Topics (all Regional & State topics + the following)
Monohybrid cross	Dihybrid cross	Pedigree construction and analysis
Dominant and recessive alleles	Sex-linked traits	Production of gametes with Abnormal #’s of chromosomes
Genotype vs. phenotype	Pedigree analysis	Trihybrid cross (probability analysis)
Human sex determination	Multiple alleles	Analysis of karyotypes for deletion, addition, translocation
Gene: protein relationship	DNA structure & replication, mutations	Molecular consequences of mutations
Mitosis, Meiosis and gamete formation	Transcription and translation	Multifactorial traits and Epistasis
Human karyotypes analysis for nondisjunction disorders	Co-dominance & incomplete dominance	PCR and DNA sequencing

4. **SAMPLE QUESTIONS:**

- In guinea pigs, short hair (S) is dominant over long hair (s). Two heterozygous dominant guinea pigs are crossed (Ss X Ss). What will be the genotype ratio of their offspring? What will be the phenotype ratio of their hair length?
- In mice, the gene for color coat (C) is dominant to the gene for albino (c), and the gene for straight whiskers (S) is dominant to the gene for bent whiskers (s). Two heterozygous dominant mice are crossed CcSs x CcSs. Show the Punnett Square of genotypes for this cross and determine the genotype and phenotype ratios for this cross.
- A man who is blood type AB marries a woman who is blood type O. What blood types might be present in their children?
- Examine a pedigree and answer questions about sex of individuals, relationships, phenotype, and genotypes.
- Examine a karyotype and answer questions about sex of the individual, number of chromosomes, monosomy, trisomy, and genetic disorders.
- Examine data and/or diagrams concerning mitosis, meiosis, or DNA structure/replication and answer questions about the processes.

5. **SCORING:**

- Highest number of correct solutions will determine the winner.
- Selected questions may be used as tiebreakers.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Genetics CD and Bio/Earth Science CD; other resources are on the event page at soinc.org.

This event is sponsored by Corteva Agriscience



1. **DESCRIPTION:** Teams will complete a written test on simple, Division B, and compound, Division C, machine concepts and construct a lever-based measuring device prior to the tournament to determine the ratio between two masses.

A TEAM OF UP TO: 2 **EYE PROTECTION:** B **IMPOUND:** Yes **EVENT TIME:** 50 minutes

2. **EVENT PARAMETERS:**

- Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during **any part of** the event.
- Each team may also bring tools, supplies, writing utensils, and two stand-alone calculators of any type for use during any part of the event. These items need not be impounded.
- Each team must impound their device, a device diagram, and copies of graphs and/or tables for scoring.
- All participants must properly wear eye protection during Part II – Device Testing. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without proper eye protection will not be allowed to compete in Part II – Device Testing.
- Event Supervisors will supply three masses labeled A, B, and C. A flexible loop, large enough to pass a standard golf ball through, must be tied to the top of each mass. The loops may be made from fishing line, zip ties, string, etc. **Each mass, including** the fully stretched out flexible loop, must be able to fit inside a 15.0 cm x 15.0 cm x 20.0 cm box. **Each mass** must be between 20.0 and 800.0 g. The ratio of the **heaviest mass** to the **lightest mass** must not exceed the following limit:

	Regionals	States	Nationals
Division B	4:1	5.5:1	7:1
Division C	8:1	10:1	12:1

- Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.
3. **CONSTRUCTION PARAMETERS:**
- The device must fit inside a box no larger than 100.0 cm x 100.0 cm x 50.0 cm (at impound).
 - The length of the beam is the overall longest dimension of the beam including any components that extend beyond the ends of the beam without regard to the location of the mass attachment points (but not including the supervisor provided masses).**
Division B: The device must be a class 1 lever with a single beam no longer than 80.0 cm.
Division C: The device must be a class 1 lever connected directly **via a flexible or rigid link** to a class 2 or 3 lever, each with a single beam of length less than or equal to 40.0 cm.
 - The device may be made out of any materials. Electric or electronic components are prohibited.
 - The device must be constructed to accommodate the masses, and must not include springs.
 - Participants must not bring masses or include them in devices except when fixed in place prior to impound to obtain static equilibrium. Lightweight adjustable sliding hooks used solely to accommodate the masses are allowed and need not be fixed in place.
 - Prior to competition, teams must calibrate devices by preparing graphs/tables showing the relationship between masses and device configuration parameters. A labeled device diagram should be included.
 - Any number of graphs and/or data tables may be submitted but the team must indicate up to four to be used for the Chart Score, otherwise the first four provided are scored.
 - Graphs and/or tables may be computer generated or drawn by hand on graph paper. Each data series counts as a separate graph. A template is available at www.soinc.org.
 - Teams are encouraged to have a duplicate set to use, as those submitted may not be returned.

4. **THE COMPETITION:**

Part I: Written Test

- Teams will be given a minimum of 20 minutes to complete a written test consisting of multiple choice, true-false, completion, or calculation questions/problems.
- Unless otherwise requested, answers must be in metric units with appropriate significant figures.
- The written test will consist of questions about simple and, in Division C only, compound machines, including at least five of the following topics: ideal and actual mechanical advantage, efficiency, load, effort, potential and kinetic energy, and coefficient of friction.**



- d. Questions are limited to the following simple machines (or, in Division C, combinations thereof) and must include at least five of the following topics: Levers (all three classes), inclined planes, wedges, wheel and axle (including gears), pulleys, and (in Division C only) screws.
- e. Questions dealing with the topics listed above may require additional knowledge from the field of classical mechanics, including Newton's laws of motion, inertia, force, impulse, action-reaction, kinematics, position, speed, velocity, acceleration, momentum, kinetic and potential energy, and conservation of energy and momentum.

Part II: Device Testing

- a. The objective is to quickly determine the ratios of three unknown masses using a simple lever in Division B or compound lever in Division C.
- b. At the start of the competition block, teams will be given 5 minutes to set up or modify their devices and use their graphs and/or tables to calibrate them. Devices that do not meet the construction specs will not be allowed to be tested until brought into specification.
- c. While all teams are working on Part I, the Event Supervisor will individually call each team to a station. Multiple identical stations may be used, but all teams will use identical masses.
- d. Part II timing (not to exceed 4 minutes) begins when the Event Supervisor provides the masses to the team. The Supervisor must ensure that the mass values are not revealed to any teams. Teams must not touch the masses until time begins.
- e. Using the basic physical principles of a lever and adjusting only the relative positions of the masses and/or fulcrum(s) along the lever beam(s), teams must calculate the ratios of the masses. Teams may work with either two or three masses at a time. Teams may use their resources, calculators, and tools to determine mass ratios. **Teams may submit mass ratios in any equivalent format (i.e., decimal, fraction). However, fractions must not be complex fractions (e.g., having a decimal or fraction in the numerator or denominator).**
- f. Teams must not mark on, attach anything to, or modify the masses.
- g. Part II timing stops when the team provides the Supervisor with the calculated mass ratios A/B and B/C or 4 minutes has elapsed. Event Supervisors must record the elapsed time in seconds to the precision of the timing device. No changes are allowed to the calculated values once timing stops.
- h. The Supervisor will review with the team the Part II data recorded on their scoresheet.
- i. Teams filing an appeal regarding Part II must leave their device in the competition area.

5. SCORING:

- a. High score wins; Final Score (FS) = ES + R1 + R2 + TS + CS. The maximum possible FS score is 100 points. A scoring spreadsheet is available at www.soinc.org.
- b. Exam Score (ES) = (Part I score / Highest Part I score for all teams) x 45 points.
- c. Time Score (TS) = ((240 - team's part II time in seconds) / 240) x 15 points.
- d. Ratio Scores (R1 and R2) = (1 - (abs(AR - MR) / AR)) x 15 points. The smallest possible R1 and R2 is 0. AR is the actual ratio of two of the masses (measured to the best precision of the equipment available to the Event Supervisor) and MR is the measured value of the ratio as submitted by the team. R1 uses mass ratio A/B, R2 uses mass ratio B/C.
- e. Chart Score (CS): One of the submitted graphs/tables, selected by the Event Supervisor, is scored using i., ii., and, iii., described below for a maximum of 6 points. Four (4) additional CS points are available via items iv. and v. Partial credit may be given. A device must be present to receive a CS.
 - i. 2 points for including data spanning the possible mass range
 - ii. 2 points for including at least 10 data points in each data series
 - iii. 2 points for proper labeling (e.g., title, team name, units)
 - iv. 0.5 points for each distinct graph or table turned in (up to 2 points total)
 - v. 2 points for including a labeled device diagram
- f. If a team violates a COMPETITION rule, their TS, R1, and R2 scores will be multiplied by 0.9.
- g. If any CONSTRUCTION violation(s) are corrected during the competition block, or if the team misses impound, their TS, R1, and R2 will be multiplied by 0.7.
- h. Teams with no device, no ratio estimates, or that do not make an honest attempt to utilize a device of the prescribed type to determine the mass ratios receive R1, R2, and TS of 0. Such teams will be allowed to compete in Part I (the written test).
- i. Tie Breakers: 1st - Best ES; 2nd - Best TS; 3rd - Best R1; 4th - Best R2.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the classic Machines Lecture Video and the Chem/Phys Science CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Teams will **demonstrate** their understanding of meteorological principles associated with severe weather by **analyzing and interpreting** meteorological data, graphs, charts, & images.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each team may bring two stand-alone **calculators of any type** & two 8.5" x 11" sheets of paper, which may be in individual sheet protectors sealed by tape or laminated, that may contain information on both sides in any form & from any source without any annotations or labels affixed.
- Teams will not be required to bring any additional supplies or materials for any hands-on task, demonstration or lab exercise.

3. **THE COMPETITION:**

The questions will address the following Severe Weather and Storms topics:

- Environmental conditions leading to severe weather including large-scale circulation patterns, jet streams, atmospheric stability, and boundaries (e.g., fronts & drylines)
- Clouds: identification & interpretation of cloud types, related to severe weather events**
- Severe thunderstorms: types (e.g., multicell & supercell), characteristics, structure & life cycles**
- Precipitation from severe storms, including the relationship of precipitation intensity, duration, and frequency to impacts of heavy precipitation**
 - Solid precipitation (e.g., snow, sleet, hail) & impacts (e.g., avalanches, travel hazards, whiteouts)**
 - Liquid precipitation (e.g., freezing rain/drizzle, heavy rain) & impacts (e.g., debris flows & mudslides and flash, river, & urban flooding)**
 - State and National Tournaments - Intensity-duration-frequency (IDF) curves and return periods for precipitation events**
- Squall lines & mesoscale convective complexes
- Straight-line winds: downdrafts, downbursts, microbursts, macrobursts, gust fronts, derechos, downslope winds**
- Electrification of clouds, all types of lightning strikes and lightning direction finders/systems
- Tornadoes & Waterspouts: life cycles, climatology, characteristics, structure, Fujita & E-Fujita Scales
- Severe winter storms & characteristics: blizzards, nor'easters, lake effect snowstorms & freezing rain
- Hurricanes, Typhoons and Cyclones: life cycles, climatology, characteristics, structure, origin/distribution, Saffir-Simpson Scale & storm surge
- Hazards from all of the above (c. – j.)
- Observation technologies, including surface observation networks (e.g., ASOS, high-resolution mesonets), radiosondes, buoys, Doppler radar, aircraft, satellite (e.g., water vapor, visible, & IR)**
- Types of data** used to forecast & monitor severe events: surface & upper air (850, 700, 500, & 300 mb) maps, computer model predictions & Doppler radar images, including interpretation of severe features (e.g., such as bow echo, tornadic vortex signature (TVS), hook echo, & debris ball)
- Weather safety: NOAA warnings/watches, dependable weather information sources for preparedness & during severe weather
- Severe Weather Events & Cases - 2020 Hurricanes plus Dorian, Florence, Harvey, Irma, Maria, Michael; 2020 & 2021 Blizzards plus U.S. Mar./Apr. 2019; 2020 & 2021 Floods plus 2019 Midwest U.S.; 2020 & 2021 Tornado outbreaks plus U.S. Mar./Apr. 2019**

4. **SAMPLE QUESTIONS/TASKS:**

- Use surface and upper air maps to determine the most likely location of severe weather.
 - Analyze storm damage photos, locations, radar & satellite images to identify storm types.**
 - Demonstrate knowledge of the life cycle of different severe storms and be able to associate those conditions with radar, station model data & fronts on weather maps
 - Relate specific hazardous conditions to different types of severe storms and interpret their significance
 - Interpret the three-dimensional structure of severe storms using Doppler radar & satellite images
5. **SCORING:** High score wins. Points will be awarded for the quality of responses, the quality of supporting reasoning, and use of scientific technique. Pre-identified questions will be used as tiebreakers.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Meteorology CD, the Bio/Earth Science CD, and the *Audubon Weather* meteorology field guide; other resources are on the event page at soinc.org.

This event is sponsored by National Oceanic and Atmospheric Administration (NOAA)



1. **DESCRIPTION:** 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.

A TEAM OF UP TO: 2

IMPOUND: State & National only

EYE PROTECTION: C

SET-UP TIME: 30 minutes for points

MAXIMUM RUN TIME: 3 minutes

2. **EVENT PARAMETERS:**

- At State and National Tournaments, teams must impound their Device along with any tools or parts that they will use during their set-up time or run. **Electric outlet access will not be available.**
- All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not compete.
- Each Device must pass a safety inspection before operation. Devices with potential hazards or safety concerns must not be permitted to run unless safety concerns are resolved to the satisfaction of the Event Supervisor, otherwise they must receive only participation points.
- Event Supervisors will need their own eye protection (i.e.; safety glasses), meter sticks, stopwatches, and measuring tape.
- Participants must be able to answer questions regarding the design, construction, and operation of the Device per the Building Policy found on www.soinc.org.

3. **CONSTRUCTION PARAMETERS:**

a. **General Requirements:**

- During operation, the Device's outer dimensions should be no greater than 60.0 cm (L) x 60.0 cm (D) x 60.0 cm (H). Devices with a dimension greater than 1 meter will not be allowed to run.
- All actions used for scoring must be visible and/or verifiable. The top and at least two vertical walls must be open or transparent for viewing all actions. Actions must be consecutive. Parallel and/or dead-end actions will not count for points. Any action in the Device not designed to contribute to the completion of the Final Action will not count for points.
- A standard, unmodified wooden or plastic golf tee must be placed into or attached to a "tee holder" somewhere in the Device for the Final Action. The golf tee may have any length, but the diameter must be no greater than 1.25 cm ($\frac{1}{2}$ inch). The tee may be glued or taped to the "tee holder" as long as the top 2.5 cm is above the top of the tee holder and completely free of glue/tape.
- Each movable/adjustable physical object in the Device must be utilized by at most one assigned action. **An object at the end of one action may initiate the next action, but must not go beyond the initiation of the second action. (The initial golf ball may start the first action, as described, but must then remain at rest until it is moved in the Final Action.)**
- Sensitive components (i.e.; springs/mousetraps, dominoes) may be set/placed just before starting the Device.
- Use of electricity is prohibited except in action 3.c.x. Only commercial batteries, not exceeding 9 volts as labeled may be used. Multiple batteries may be connected in series or parallel as long as the expected voltage output across any two points does not exceed 9 volts as calculated using their labeled voltage. Teams must be able to show the Event Supervisors the labeled voltage. Non-complaint batteries must be removed prior to Device operation.
- Candles, flames, matches, hazardous liquids, **lead objects (even if encased)**, gases, and hazardous materials (e.g., rat traps, combustible fuses, dry ice, liquid nitrogen) and unsafe handling of chemicals will not be permitted.
- All golf balls in the Device must be standard and unmodified. They may have small nicks, scratches and ball marks due to normal use, but must otherwise retain all of their original material and structural integrity. They may be tied but must not be glued or taped. **If the golf ball is to start the next action, the actual golf ball (not what is holding or attached to the golf ball) must initiate the next action.**

- b. Start Action: (100 points) - Participants must drop a golf ball (3.a.viii.) into the Device from a point completely above the Device. The golf ball must fall into the Device and initiate the next action, **and come to rest.**

- c. Scorable Actions: (50 points each) – Participants may have up to 12 scorable unique actions to count for points. Participants may attempt, none, some, or all of these actions in any order.

- Use a 3:1 **or 1:3** ratio gear system to initiate the next action.



- ii. Rotate a wheel and axle to raise a golf ball (3.a.viii.) at least 10 vertical cm, so that the golf ball at the end of the lift initiates the next action. **(This can be wheel to axle or axle to wheel in direction.)**
 - iii. Knock over in series, four free-standing, standard, non-magnetic, commercial dominos with the fourth domino in the sequence initiating the next action.
 - iv. Add **plain** water to a container to raise a golf ball (3.a.viii.) at least 5 cm so that the golf ball rolls out of the top of the container and initiates the next action.
 - v. Rotate a screw to move a wingnut threaded on the screw at least 2 horizontal cm. After moving at least 2 horizontal cm the wingnut must contact an object which initiates the next action.
 - vi. Push or pull a golf ball (3.a.viii.) up an inclined plane with an ideal mechanical advantage (IMA) ≥ 2 . After rising at least 10 vertical cm, the golf ball must initiate the next action.
 - vii. Use a Pulley (system) with an ideal mechanical advantage (IMA) ≥ 2 to lift a golf ball (3.a.viii.). After rising at least 10 vertical cm, the golf ball must initiate the next action.
 - viii. Use a 3rd class lever to raise a golf ball (3.a.viii.) at least 5 vertical cm. After rising at least 5 vertical cm, the golf ball must initiate the next action.
 - ix. Pull a wedge from under a golf ball (3.a.viii.) so that it rolls. After rolling 20 cm in any direction, the golf ball must initiate the next action.
 - x. **Start a stationary fan (using no more than 9V)**, which uses moving air to push a floating object. After moving at least 10 horizontal cm on water, the floating object must initiate the next action.
 - xi. Push a wedge between two golf balls that are touching so that one golf ball moves. After moving at least 20 cm in any direction, the golf ball(s) (3.a.viii.) must initiate the next action.
 - xii. Start a pendulum so that after running for at least 10 seconds, it initiates the next action.
- d. Final Action:
- i. After all other planned scorable actions have been attempted, the golf ball from the Start Action in 3.b. must be moved at least 20 horizontal cm from its original resting position and placed on the golf tee (as described in 3.a.iii.) so that it stays on the tee for at least three seconds. (250 points) To get the points, the ball must only be touching the tee and nothing else.
 - ii. If the part of the Device that delivered the ball to the tee is then automatically moved away so the ball is clearly unobstructed in all directions, an additional 150 points will be awarded. The ball must stay on the tee and no part of the Device (except the tee and tee holder) can be within 10 cm of the ball in any direction. This can occur after timing stops. **If this part of the device goes outside the original dimensions, the dimensions (and scoring) will be changed to allow for this action. If this change exceeds the dimension limits, penalties will be assessed.**
- e. Action Sequence List (ASL):
- i. Two Action Sequence Lists (ASLs) must be submitted to the Event Supervisor at impound for States & Nationals. At Regional Tournaments, ASLs should be provided to Event Supervisors just prior to the start of competition.
 - ii. An ASL is a written documentation of all the actions within the Device. Its purpose is to allow the Event Supervisor to follow along the chain of events while the Device is running.
 - iii. Each scorable action in 3.c. may only earn points once in the ASL. Other non-scorable actions may be incorporated into the Device but must contribute to the completion of the Final Action, receive no points and be listed on the Action Sequence List (ASL).
 - iv. All scorable and non-scorable actions must be numbered in the Device, and correspondingly numbered in the ASL.
 - v. An example of an ASL can be found on www.soinc.org.
4. **THE COMPETITION:**
- a. The Target Operation Time is 60 seconds at Regionals/Invitationals, 61 to 90 seconds at State, and 91 to 120 seconds at Nationals. For State and National tournaments, time will be announced after impound is over and at setup. The target time will be the same for all teams at State and Nationals.
 - b. Timing and scoring begin when a participant drops a golf ball (3.b.) into the Device. Timing and scoring (with the exception of 3.d.ii.) stop when the golf ball from the Start Action touches the golf tee or after 180 seconds has elapsed, whichever comes first.
 - c. Participants may designate a timer, an action taking over 10 seconds that does not use electricity or springs for power, to be eligible for bonus points. **This timer may be one of the scorable actions.**
 - i. A 1-point bonus will be awarded for every full second the timer runs before the Target Operation Time. The timer may run past the Target Operation Time but will not receive points for the duration after the Target Operation Time.



- ii. The timer must successfully initiate the next action for any bonus points to count.
 - iii. For State/National tournaments, the team must demonstrate how this timer is adjusted to account for the increased length of Target Operation Time for the bonus points to count.
 - d. If the Device stops, jams, or fails, the participants will be allowed to adjust it to continue operation up to three times. An adjustment may consist of multiple physical touches and is only completed once the Device runs again on its own. Obvious adjusting only to stall or impact operation time will result in disqualification.
 - e. If a participant completes a scorable action or makes an adjustment that leads directly to the completion of that action, then that action will not count for points, even if it is part of the Final Action.
 - f. If an action starts out of the ASL order, all actions skipped in the listed sequence, even if completed, earn zero (0) points.
 - g. The Supervisor will review with teams the data recorded on the scoresheet.
 - h. Teams filing an appeal must leave their Device and ASLs in the event area.
5. **SCORING:**
- a. High score wins.
 - b. Award 25 points for each of the following (100 points maximum):
 - i. The ASLs are submitted on time at Device impound for State and National tournaments
 - ii. The ASLs are legible and use the format specified on www.soinc.org
 - iii. The ASLs are 100% accurate of intended scorable and non-scorable actions
 - iv. The scorable & non-scorable actions within the Device are labeled as in the ASLs
 - c. Award 50 points for each of the following:
 - i. Participants use no more than 30 minutes to set up their Device
 - ii. The first time each unique action in 3.c. is successfully completed as described
 - d. Award 100 points for completing the Start Action
 - e. Award 250 points for completing the Final Action as described in 3.d.i.
 - f. Award 150 points for moving parts of the Device away from the golf ball as described in 3.d.ii.
 - g. Award 4 points for each full second (rounded down) of operation up to the Target Operation Time
 - h. Award 1 point per full second that a non-spring timer runs before the Target Operation Time if all conditions are met and the next action is initiated by the timer
 - i. Award 0.1 point for each 0.1 cm that the Device dimensions are under 60.0 cm in each axis. The maximum score awarded for each dimension is 30 points, for a total of 90 points
 - j. Award 75 points for a Device that has no adjustments during operation
 - k. **Teams failing to impound their device on-time will be ranked after all teams that impounded on-time.**
 - l. Teams receive only participation points for impounding a Device but not competing, unsafe Devices, **Devices with a dimension greater than 1 meter**, or Devices that are remotely timed/controlled.
6. **PENALTIES:**
- a. Deduct 2 points for each full second (rounded down) that the Device operates past the Target Operation Time up to 180.0 seconds (whichever occurs first).
 - b. Deduct 25 points:
 - i. For each dimension of the Device that exceeds 60 cm
 - ii. If the top and 2 vertical walls are not open or transparent
 - iii. For each time the Device is adjusted during operation, up to 3 times. If the Device stops or fails after the third adjustment, scoring stops and the operation time will be scored as 180 seconds.
 - c. Deduct 50 points if any solid or liquid leaves the measured dimensions of the Device.
 - d. Deduct 150 points:
 - i. For each spring timing action in the Device that takes longer than 10 seconds
 - ii. For any use of electricity in the Device except action 3.c.x.

7. **TIEBREAKERS:**

Ties are broken as follows: a) Fewest penalty points; b) Smallest overall dimension (L+D+H) of the Device.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Mission Possible Video and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

This event is sponsored by Ace Hardware Science



1. **DESCRIPTION:** Teams design, build, and test one Vehicle using one mousetrap as its sole means of propulsion to reach a target **point** as accurately as possible.

A TEAM OF UP TO: 2

IMPOUND: Yes

EYE PROTECTION: B

EVENT TIME: 10 minutes

2. **EVENT PARAMETERS:**

- Each team must bring and impound one Vehicle, alignment devices (if used), a Practice Log, and additional/spare parts. **The vehicle must be impounded with the mousetrap in its lowest potential energy state compared to an unmodified mousetrap.**
- Teams may bring data and a stand-alone calculator of any type and non-electric tools which do not need to be impounded.
- All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not be allowed to compete and will receive participation points.
- Teams must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

3. **CONSTRUCTION PARAMETERS:**

- All propulsive energy must come from one snap mousetrap with a base 6.0 cm x 12.0 cm or smaller. No part of the jaw/hammer may extend more than 1.0 cm beyond the base. The mousetrap must retain all of its original parts and structural integrity. Altering the structural integrity of the mousetrap is prohibited, including welding, bending, and cutting. Items may be added to the mousetrap through methods including, but not limited to: soldering, taping, tying, gluing, and clamping. Added items cannot increase the potential energy of the unmodified mousetrap. Up to 4 holes may be drilled in the mousetrap to attach it to the Vehicle.
- Conversion of the mechanical energy of the mousetrap is permissible, but any energy converters must be at their lowest energy states in the ready-to-run configuration. Pre-loaded energy storage devices may be used to operate other Vehicle functions (e.g., braking system) as long as they do not provide kinetic energy to propel the Vehicle.
- Electronic components and electric devices are not permitted except for calculators.
- An approximately ¼" round wooden dowel must be attached to the front of the Vehicle. When the Vehicle is placed flat on the floor, the dowel must be approximately perpendicular to the floor, extend to within 1.0 cm of the floor, and extend at least 20.0 cm above the floor. The dowel must be easily accessible by the Event Supervisor - no part of the Vehicle, except the drive arm **attached to the mousetrap (if used)** and drive string, may extend more than 0.5 cm beyond the front of the dowel. The dowel's front bottom edge will be the Vehicle's Measurement Point for distance measurements.
- In the ready-to-run configuration, all wheels/treads (in their entirety) must fit in a 40.0 cm x 40.0 cm space of any height and any orientation. Axles, drive arms, and other parts of the Vehicle may extend beyond these parameters.
- All parts of the Vehicle must move as a whole; no anchors, tethers, tie downs, launching ramps, or other separate pieces are allowed. The only parts allowed to contact the floor during the run are wheels/treads, drive string(s), and any parts already in contact with the floor in the ready-to-run configuration. Pieces falling off during the run constitutes a construction violation.

4. **PRACTICE LOG:**

- The Practice Log must include **3** or more parameters (**2** required and at least 1 additional) for 10 or more practice runs. The required parameters are: Target Distance **and** Vehicle Distance from Target. Each team must choose an additional **3rd** parameter beyond those required (e.g., # of axle turns for braking, drive arm length, alignment angle) to test. **Logs must include the Team name and number.**
- Logs must be impounded and will be returned when the team is called to compete.



5. THE COMPETITION:

- a. Only participants and the Event Supervisors will be allowed in the impound and track areas. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication.
- b. Teams have **10** minutes of Event Time to set up and start up to **3** runs. Vehicles in the ready-to-run configuration before the end of the Event Time will be allowed to complete a run.
- c. Electric tools must not be used except for the calculator in 2.b.
- d. In the ready-to-run configuration, the Vehicle's Measurement Point must be over the Start Point. The Vehicle must remain at the starting position without being touched.
- e. Teams may adjust their Vehicle (e.g., change mousetraps, distance, aiming) within their Event Time, though the Event Supervisor may re-verify that the Vehicle meets specifications prior to each run. Timing is paused during any measurements made by the Event Supervisor. Timing resumes once the participants pick up their Vehicle or begin making their own measurements. Teams may use their own non-electric measuring devices to verify the Track dimensions during their Event Time.
- f. Only non-electric sighting/aiming devices are permitted. If placed on the Track, they must be removed before each run. If placed on the Vehicle, they may be removed at the team's discretion.
- g. Teams must not roll the Vehicle on the floor of the Track on the day of the event without tournament permission. If permitted, only participants may be present.
- h. Substances applied to the Vehicle must be approved by the Event Supervisor prior to use and must not damage or leave residue on the floor, Track and/or event area. Teams may clean the Track during their Event Time but it must remain dry.
- i. Teams must start the Vehicle using any part of an unsharpened #2 pencil with an unused eraser, supplied by the Event Supervisor, in a motion approximately perpendicular to the floor, to actuate a trigger. They may not touch the Vehicle to start it, hold it while actuating the trigger, or "push" the Vehicle to get it started. Once they start a run, the participants must not follow their Vehicle and wait until called by the Event Supervisor to retrieve their Vehicle.
- j. If the vehicle does not move upon actuation of the trigger, it does not count as a run. **The team may continue to work on their device in order to attempt 3 runs within the Event Time.**
- k. A Failed Run can occur if the Vehicle starts before the Event Supervisor is ready, if its distance cannot be measured (e.g., the participants pick it up before it is measured), **or if the team pushes the vehicle down the track. If a team has a Failed Run, any Construction and/or Competition violations must be recorded for that Run as well. A team having only one successful run during the 10 minute Event Time will be assessed a Failed Run for a 2nd run score. If the Vehicle does not move during the Event Time, the team will be assessed 2 Failed Runs.**
- l. **The Event Supervisor will review with the team the data and penalties recorded on their scoresheet.**
- m. **Teams filing an appeal must leave their Vehicle and Practice Log in the event area.**

6. THE TRACK:

- a. The Track will be on a smooth, level, and hard surface. Refer to soinc.org for a diagram of the Track.
- b. The Event Supervisor will use approximately 5.0 cm by 2.5 cm pieces of tape to mark the Start and Target Points, with the Start and Target Point marked on each piece of tape.
- c. The exact Target Distance from the Start Point to the Target Point will be between 9.00 m and 12.00 m. At Regionals the interval will be 0.50 m, for States 0.25 m, and for Nationals 0.05 m. The Target Distance will be chosen by the Event Supervisor and announced after the impound period is over.
- d. At the Event Supervisor's discretion, more than one Track may be used. If so, the team may choose which Track they want to use, but must use the same Track for both runs.

7. SCORING:

- a. **Each team's Final Score is the sum of their 2 best Run Scores out of their 3 runs + any Final Score Penalties. Low score wins.**
- b. **The Run Score for each run = Distance Score + Run Penalties**
- c. **The Distance Score = 1pt./cm x Vehicle Distance. The Distance Score for a Failed Run is 2500 points.**



- d. The Vehicle Distance is the point-to-point distance from the Measurement Point to the Target Point in centimeters measured to the nearest 0.1 cm.
- e. **Run Penalties:**
 - i. **Competition Violation: 1500 points added to each Run Score that has 1 or more Competition Violations.**
 - ii. **Construction Violation: 3000 points added to each Run Score that has 1 or more Construction Violations.**
- f. **Final Score Penalties:**
 - i. **Incomplete Practice Log: 250 points added to the team's Final Score.**
 - ii. **Missing or not Impounded Practice Log: 500 points added to the team's Final Score.**
 - iii. **Vehicle Not Impounded: 10000 points add to the team's Final Score.**
- g. **Two or more teams tied with 2 Failed Run scores, without Competition or Construction Violations, will remain scored as ties. Other ties are possible.**
- h. Tiebreakers in order: **1. Better Vehicle Distance of the 2 scored runs; 2. Better Vehicle Distance of the non-scored run.**

SCORING EXAMPLE:

A Vehicle has 3 runs in the allotted time.

The 1st run has 2 Competition Violations and a Vehicle Distance of 57.8 cm.

The 2nd run has a Competition Violation and a Vehicle Distance of 143.9 cm.

The 3rd run has no Violations and a Vehicle Distance of 87.5 cm.

The team's Practice Log is incomplete.

1st run's Run Score: 57.8 pts + 1500 pts = 1557.8 pts

2nd run's Run Score: 143.9 pts + 1500 pts = 1643.9 pts (highest points, not counted in Final Score)

3rd run's Run Score: 87.5 pts

**Final Score = 1st run's Run Score + 3rd run's Run Score + Incomplete Practice Log
= 1557.8 pts + 87.5 pts + 250 pts = 1895.3 pts**

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Mousetrap Vehicle Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Participants will be assessed on their knowledge of North American birds.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Each team may bring one 2” or smaller three-ring binder, as measured by the interior diameter of the rings, containing information in any form and from any source along with one commercially produced field guide not contained in the binder. Sheet protectors, lamination, tabs and labels are permitted in both the binder and field guide.
- b. If the event features a rotation through a series of stations where the participants interact with samples, specimens or displays; no material may be removed from the binder throughout the event.
- c. In addition to a binder, each team may bring one unmodified and unannotated copy of either the **2021** National Bird List or a **2021** Official State Bird List which does not have to be secured in the binder.

3. **THE COMPETITION:**

- a. The competition may be run as timed stations and/or as a timed slides/PowerPoint presentation.
- b. Specimens/pictures will be lettered or numbered at each station. The event may include preserved specimens, skeletal material, recordings of songs, and slides or pictures of specimens.
- c. **For each station, Regional tournaments will have questions about 1 bird per station, State tournaments will use no more than 2 birds per station, and the National Tournament may use 3 or more birds per station.**
- d. Each team will be given an answer sheet on which they will record answers to each question.
- e. No more than 50% of the competition will require giving **order, family, and/or common name**.
- f. Participants should be able to do basic identification to the level indicated on the Official List. States may have a modified state or regional list. See your state web site.
- g. States may have a modified state or regional list which will be posted on the state website no later than November 1st.
- h. The National competition will be based on the **2021** National Bird List.
- i. Each specimen will have one or more questions accompanying it on some aspect of its life history, distribution, anatomy and physiology, reproduction, habitat characteristics, ecology, diet, behavior, conservation and biogeography.
- j. The ecology questions may pertain to any ecological aspect of the species, including behavior, habitat, niche, symbiotic relationships, trophic level, adaptive anatomy such as bill size and shape, migration, distribution or occurrence (e.g., rare, common, special concern, endangered).

4. **SAMPLE ACTIVITIES:**

- a. Identify the order, family, and/or **common name** of the provided sample.
- b. What conclusion can be drawn about the habitat(s) of the given specimens?
- c. Which of these animals does not fit within this taxon?
- d. What unique anatomical feature distinguishes the animal shown in the picture?
- e. Consider the potential impact of human activities on the survival of birds.

5. **SCORING:**

- a. High score wins.
- b. Selected questions may be used as tiebreakers.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Bio/Earth Science CD, Taxonomy CD, and *Peterson's Field Guide to Birds of North America*; other resources are on the event page at soinc.org.



2021 NATIONAL BIRD LIST

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.



Kingdom – ANIMALIA

Phylum – CHORDATA

Subphylum – VERTEBRATA

Class - AVES

Family Group (Family Name)

Common Name

ORDER: Anseriformes

Ducks, Geese, and Swans (*Anatidae*)

Black-bellied Whistling-duck

Snow Goose

Canada Goose

Trumpeter Swan [♂]

Wood Duck

Mallard [♂]

Northern Shoveler

Green-winged Teal

Canvasback

Hooded Merganser

ORDER: Galliformes

Partridges, Grouse, Turkeys, and Old

World Quail (*Phasianidae*)

*Ring-necked Pheasant

Ruffed Grouse [♂]

Wild Turkey

New World Quail (*Odontophoridae*)

Northern Bobwhite [♂]

ORDER: Gaviiformes

Loons (*Gaviidae*)

Red-throated Loon

Common Loon [♂]

ORDER: Podicipediformes

Grebes (*Podicipedidae*)

Pied-billed Grebe

Red-necked Grebe

ORDER: Procellariiformes

Albatrosses (*Diomedidae*)

Laysan Albatross

Shearwaters and Petrels

(*Procellariidae*)

Northern Fulmar

ORDER: Pelecaniformes

Pelicans (*Pelecanidae*)

American White Pelican

Bitterns, Herons, and Allies (*Ardeidae*)

American Bittern [♂]

Great Blue Heron

Snowy Egret

Green Heron

Black-crowned Night-heron

Ibises and Spoonbills

(*Threskiornithidae*)

Roseate Spoonbill

ORDER: Suliformes

Cormorants (*Phalacrocoracidae*)

Double-crested Cormorant

Darters (*Anhingidae*)

Anhinga

Frigatebirds (*Fregatidae*)

Magnificent Frigatebird

ORDER: Ciconiiformes

Deep-water Waders (*Ciconiidae*)

Wood Stork

ORDER: Falconiformes

Caracaras and Falcons (*Falconidae*)

Crested Caracara

American Kestrel

Peregrine Falcon

ORDER: Accipitriformes

Osprey (*Pandionidae*)

Osprey

Hawks, Kites, Eagles, and Allies

(*Accipitridae*)

Bald Eagle [♂]

Northern Harrier

Cooper's Hawk

Red-tailed Hawk [♂]

Golden Eagle

ORDER: Cathartiformes

New World Vultures (*Cathartidae*)

Turkey Vulture

California Condor

ORDER: Gruiformes

Rails, Gallinules, and Coots (*Rallidae*)

Clapper Rail

Sora [♂]

Purple Gallinule

American Coot

Cranes (*Gruidae*)

Whooping Crane [♂]

ORDER: Charadriiformes

Lapwings and Plovers (*Charadriidae*)

American Golden-Plover

Killdeer [♂]

Oystercatchers (*Haematopodidae*)

American Oystercatcher

Stilts and Avocets (*Recurvirostridae*)

Black-necked Stilt

American Avocet

Sandpipers, Phalaropes, and Allies

(*Scolopacidae*)

Spotted Sandpiper

Ruddy Turnstone

Dunlin

Wilson's Snipe

American Woodcock

Gulls, Terns, and Skimmers (*Laridae*)

Laughing Gull [♂]

Ring-billed Gull

Herring Gull

Least Tern

Caspian Tern

Black Tern

Black Skimmer

Auks, Murres, and Puffins (*Alcidae*)

Common Murre

Tufted Puffin

ORDER: Columbiformes

Pigeons and Doves (*Columbidae*)

Mourning Dove [♂]

Common Ground-Dove

*Rock Pigeon

ORDER: Cuculiformes

Cuckoos, Roadrunners, and Anis

(*Cuculidae*)

Black-billed Cuckoo [♂]

Greater Roadrunner

1) Special Characters: [♂] indicates vocalizations that may be tested & * indicates an introduced, widespread Species

2) The taxonomic scheme is based upon the 7th edition Checklist of North American Birds, American Ornithologists' Union, and www.allaboutbirds.org
Cornell University Laboratory of Ornithology.



ORDER: Strigiformes

Barn Owls (*Tytonidae*)

Barn Owl

Typical Owls (*Strigidae*)

Great Horned Owl [♂]

Snowy Owl

Barred Owl [♂]

Screech Owl

ORDER: Caprimulgiformes

Nightjars and Allies (*Caprimulgidae*)

Chuck-will's-widow [♂]

Common Nighthawk

ORDER: Apodiformes

Swifts (*Apodidae*)

Chimney Swift

Hummingbirds (*Trochilidae*)

Ruby-throated Hummingbird [♂]

ORDER: Coraciiformes

Kingfishers (*Alcedinidae*)

Belted Kingfisher [♂]

ORDER: Piciformes

Woodpeckers and Allies (*Picidae*)

Red-headed Woodpecker

Yellow-bellied Sapsucker

Downy Woodpecker

Northern Flicker [♂]

Pileated Woodpecker

ORDER: Passeriformes

Tyrant Flycatchers (*Tyrannidae*)

Olive-sided Flycatcher

Eastern Phoebe

Vermilion Flycatcher

Great Crested Flycatcher [♂]

Eastern Kingbird

Scissor-tailed Flycatcher

Shrikes (*Laniidae*)

Loggerhead Shrike

Vireos (*Vireonidae*)

Warbling Vireo

Red-eyed Vireo

Jays and Crows (*Corvidae*)

Steller's Jay

Blue Jay [♂]

Black-billed Magpie

American Crow [♂]

Common Raven

Larks (*Alaudidae*)

Horned Lark

Swallows (*Hirundinidae*)

Purple Martin

Cliff Swallow

Barn Swallow

Chickadees and Titmice (*Paridae*)

Black-capped Chickadee [♂]

Tufted Titmouse [♂]

Nuthatches (*Sittidae*)

Red-breasted Nuthatch [♂]

White-breasted Nuthatch

Creepers (*Certhiidae*)

Brown Creeper

Wrens (*Troglodytidae*)

Cactus Wren

Marsh Wren

Carolina Wren [♂]

Dippers (*Cinclidae*)

American Dipper

Kinglets (*Regulidae*)

Golden-crowned Kinglet

Ruby-crowned Kinglet

Gnatcatchers (*Poliptilidae*)

Blue-gray Gnatcatcher

Thrushes (*Turdidae*)

Eastern Bluebird

Wood Thrush [♂]

American Robin [♂]

Mockingbirds and Thrashers

(*Mimidae*)

Gray Catbird

Northern Mockingbird [♂]

Brown Thrasher

Waxwings (*Bombycillidae*)

Cedar Waxwing

Wood-Warblers (*Parulidae*)

Yellow Warbler

Magnolia Warbler

Yellow-rumped Warbler

Black-throated Green Warbler

Black-and-white Warbler

American Redstart

Ovenbird

Kentucky Warbler

Common Yellowthroat [♂]

New World Sparrow

(*Passerellidae*)

Spotted Towhee [♂]

Black-chinned Sparrow

Lark Sparrow

Harris's Sparrow

White-crowned Sparrow

Chipping Sparrow

Dark-eyed Junco

Longspurs and Buntings (*Calcariidae*)

Lapland Longspur

Snow Bunting

Cardinals and Allies (*Cardinalidae*)

Northern Cardinal [♂]

Indigo Bunting

Painted Bunting

Scarlet Tanager

Blackbirds (*Icteridae*)

Bobolink

Red-winged Blackbird [♂]

Western Meadowlark [♂]

Yellow-headed Blackbird

Common Grackle

Brown-headed Cowbird

Baltimore Oriole [♂]

Fringillids and Allies (*Fringillidae*)

Red Crossbill

American Goldfinch

Evening Grosbeak

House Finch

Pine Siskin

Old World Sparrows (*Passeridae*)

*House Sparrow

Old World Starlings (*Sturnidae*)

*European Starling

1) Special Characters: [♂] indicates vocalizations that may be tested & * indicates an introduced, widespread Species

2) The taxonomic scheme is based upon the 7th edition Checklist of North American Birds, American Ornithologists' Union, and www.allaboutbirds.org
Cornell University Laboratory of Ornithology.



1. **DESCRIPTION:** Prior to the tournament, teams will design, build, and bring up to two bottle rockets to the tournament to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

A TEAM OF UP TO: 2 **IMPOUND:** No **EYE PROTECTION:** B **EVENT TIME:** 5 minutes

2. **EVENT PARAMETERS:**

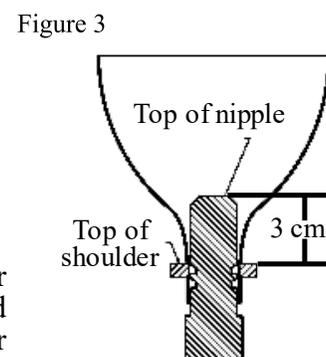
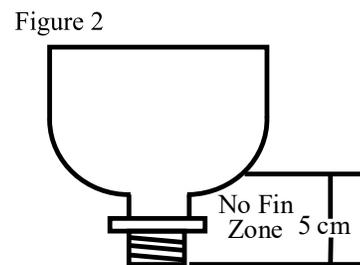
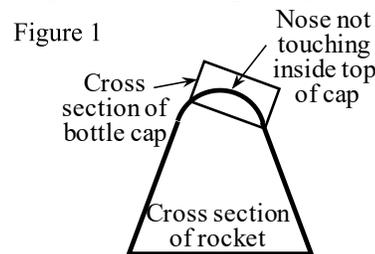
- Teams must provide up to two rockets, two unaltered standard ping pong balls, and two parachutes.
- Parachutes must be attached to ping pong balls with tape only. The ping pong ball attached to the parachute assembly makes up the parachute payload system.
- All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not compete.
- Event Supervisors must provide a launcher (that uses a Schrader valve), an air pump, a pressure gauge, and timing devices. Teams may bring their own manual bicycle pump with a pressure gauge to use, but it must attach to the launcher provided by the Event Supervisor.
- This event should be held inside with a high ceiling (greater than 20 feet recommended). Tournament directors must provide the ceiling height (in feet) to teams at least 1 month in advance. Extreme care must be taken to protect the floor and ceiling of any inside facilities used for practice and competition.

3. **CONSTRUCTION PARAMETERS:**

- Rocket pressure vessels must be made from a single 1-liter or less plastic carbonated beverage bottle with a nozzle opening internal diameter of approximately 2.2 cm (a 1/2-inch Schedule 40 PVC pipe must fit tightly inside the nozzle opening) and a standard neck height from flange to bottle's opening of under 1.6 cm. The bottle label must be presented **at check in**.
- The structural integrity of the pressure vessel must not be altered. This includes, but is not limited to: physical, thermal or chemical damage (e.g., cutting, sanding, using hot or super glues, spray painting).
- The nose of the rocket must be rounded or blunt at the tip and designed such that when a standard bottle cap (~3.1 cm diameter x 1.25 cm tall) is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1).
- Only tape must be used to attach fins and other components to the **outside of the pressure vessel. Nothing may be added to or placed on the inside of the pressure vessel.** No glues of any type may be used on the pressure vessel. Metal of any type is prohibited anywhere on the rocket or parachute payload system.
- Fins and other parts added to the bottle must be 5 cm or higher above the level of the bottle's opening, to ensure rockets fit on the launcher (see Figure 2).
- All energy imparted to the rocket/parachute payload system must originate from air pressure provided by the **tire pump**; no water. Gases other than air, explosives, liquids including water, chemical reactions, pyrotechnics, electrical devices, elastic powered flight assists, throwing devices, remote controls, and tethers are prohibited at any time.
- At the National Event the launcher nipple will extend into the rocket 1.173 in +/- 0.02 in (3.0 cm +/- 0.5 cm) above the top side of the shoulder of the bottle (see Figure 3).

4. **PRACTICE LOG:**

- During inspection, each team must present a flight log of recorded data for each rocket **design**. Data must include 5 or more parameters (3 required and at least 2 additional) for 15 or more test flights prior to the competition for each rocket. The required parameters are: 1) pressure (psi), 2) estimated/recorded peak flight height (feet), 3) time aloft (seconds). The additional parameters are chosen by the team (examples include: # fins, parachute diameter, etc.).
- Teams must use their data to justify their pressure choice. Rockets without a flight log or an incomplete log will NOT be launched.





5. THE COMPETITION:

- a. Teams must arrive at the competition site ready to launch with proper eye protection to have their rocket(s) inspected for safety.
- b. Teams will have 5 minutes to make a total of two launches using the same rocket or two different rockets.
- c. When called to launch, teams will load their rocket onto the launcher. Once the rocket is loaded, but NOT pressurized, teams will place the parachute payload system on or in the rocket. After the payload parachute system is loaded it cannot be manipulated. Teams will then pressurize the rocket to the pressure (psi) of choice based on their practice log data. **At no time should the pressure vessel (bottle) be pressurized beyond the lesser value of 65 psi or the maximum pressure determined by the Event Supervisor for safe operations given ceiling height at the tournament location.** The Event Supervisor will check the gauge on the pump to ensure the rocket is pressurized to the psi chosen and justified by the team's data.
- d. The Event Supervisor will make sure 3 timers are ready and then signal a team member to make a loud announcement of, "3, 2, 1, LAUNCH!" Then a team member will proceed to launch the rocket. After launching, the team will prepare for the next launch.
- e. Timing begins when the rocket separates from the launcher and stops when the parachute payload system lands. The parachute payload system must separate from the rocket.
- f. If the parachute payload system does not separate from a rocket, timing is from when the rocket separates from the launcher to when any part of rocket touches the ground. This launch is placed in Tier 2.
- g. If any part of a rocket or parachute payload system hits the ceiling or any part connected to the ceiling (e.g., a rafter, light, basketball hoop), then timing is stopped at the instant of contact. That launch is placed in Tier 3.
- h. If a rocket fails to separate from the launcher because of a problem with the supplied launcher then the launch never occurred and the launch can be restarted.
- i. All times for each launch MUST be recorded for breaking ties. Time aloft is recorded in hundredths of a second. The middle value is the officially recorded time.
- j. Teams filing an appeal must leave their rocket(s), parachute payload system(s), and Practice Log(s) in the event area.

6. SCORING:

- a. Ranking is determined by the greatest time aloft of a parachute payload system from a single launch within a tier.
- b. Rockets and/or parachute payload systems violating 2.c., 3.a.-f. and/or 4.a.-b. will NOT be launched. Teams unable to make any launches will receive participation points only.
- c. Ties will be broken by the best tier and/or greatest time aloft of the parachute payload system from each tied team's other launch.
- d. Tiers: The highest number Tier will be applied when more than one is applicable:
 - i. Tier 1: A launch with no violations or problems
 - ii. Tier 2: A launch where the parachute payload system did not separate from the rocket
 - iii. Tier 3: A launch where the rocket or any part of the parachute payload system contacted the ceiling

Recommend Resources: The Science Olympiad Store (store.soinc.org) carries the Ping Pong Parachute Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

This event is sponsored by Lockheed Martin



- DESCRIPTION:** Students will demonstrate an understanding of the properties and evolution of stars and galaxies as well as their observation using different portions of the electromagnetic spectrum (e.g., Radio, Infrared, Visible, Ultraviolet, X-Ray, Gamma Ray).

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

- EVENT PARAMETERS:**

- Each team may bring two 8.5" x 11" sheets of paper, which may be in sheet protectors sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed.
- Each team may bring two non-programmable, non-graphing calculators as well as two clipboards and two red-filtered flashlights.

- THE COMPETITION:**

This event is divided into two parts. Notes may be used during both parts.

Part I: Written Exam

- Participants may be asked to identify the stars, constellations, and deep sky objects included in the lists below as they appear on star charts, H-R diagrams, portable star labs, photos, or planetariums, and must be knowledgeable about the evolutionary stages of all stars and deep sky objects on the list below. Note: Constellations are underlined; **Stars** are boldface; *Deep Sky Objects* are italicized.

Andromeda: *M31 (Andromeda Galaxy)*

Aquila: **Altair**

Auriga: **Capella**

Bootes: **Arcturus**

Cancer: ***DLA0817g***

Canis Major: **Sirius**

Canis Minor: **Procyon**

Centaurus: *NGC5128*

Coma Berenices: *NGC4676, NGC4555*

Corvus: *NGC4038/NGC4039*

Crux: *Dragonfish Nebula*

Cygnus: **Deneb**

Dorado: *30 Doradus, LMC*

Gemini: **Castor, Pollux**

Lyra: **Vega**

Ophiuchus: **Zeta Ophiuchi,**

Rho Ophiuchi cloud complex

Orion: **Betelgeuse, Rigel & M42 (Orion Nebula)**

Perseus: **Algol, NGC1333**

Sagittarius: *Sgr A*, M8 (Lagoon Nebula)*

Sextans: *Baby Boom Galaxy*

Scorpius: **Antares, NGC6357, NGC6334**

Taurus: **Aldebaran, T Tauri**

Tucana: *SMC*

Ursa Major: **Mizar, Alcor, GN-z11, M101**

Ursa Minor: **Polaris**

Virgo: **Spica, M60, M104**

Part II: Hands-on or Interpretive Task

- Participants will be asked to complete one or more hands-on or interpretive tasks selected from the following topics:
 - Stellar and galactic evolution
 - Spectral classification of stars
 - Hubble classification of galaxies
 - Observation using multiple portions of the electromagnetic spectrum
 - The relationship between stellar temperature, radius, and luminosity
 - Magnitude and luminosity scales, distance modulus, inverse square law
- SAMPLE PERFORMANCE TASKS:**
 - Given the properties and/or spectra of stars and deep sky objects, participants will identify their proper placement on an H-R Diagram.
 - Given a set of images observing a star or deep space object with different portions of the electromagnetic spectrum, identify which images correspond to which portion of the spectrum and describe what features are prominent in each observation and why.
 - SCORING:**
 - High score wins. Each task and/or question will have been assigned a predetermined number of points.
 - Ties will be broken by the accuracy and thoroughness of responses.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Reach for the Stars CD, *Audubon Field Guide to the Night Sky* and the Bio/Earth CD; other resources are on the event page at soinc.org.

This event is supported by NASA's Universe of Learning Astrophysics STEM Learning and Literacy Network



1. **DESCRIPTION:** Participants will answer interpretive questions that may use one or more state highway maps, USGS topographic maps, Internet-generated maps, a road atlas, or satellite/aerial images.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Teams may bring two stand-alone non-programmable, non-graphing calculators, protractors, rulers, other measuring devices, USGS Map Symbol Sheet, and hard copies of other information in any form and from any source along with colored marking devices consistent with the colors utilized on USGS topographic maps. The equipment and reference materials may be in a container.
 - b. **The event supervisor will provide all required maps and images. Participants may NOT write on the maps. If a student-generated map is included, a one mile-square PLSS section will be printed on the answer sheets. Graphing axis will be provided for profile problems. Event supervisors will check the accuracy of scales on reproduced maps or images prior to competition.**
3. **THE COMPETITION:** The satellite images, highway, and quadrangle maps may be from one or more states. The event may be presented in a storyline format. Satellite/aerial photos will be in the visible light spectrum. **Items marked with an asterisk (*) should be written at an introductory level for Regional Tournaments.**

Topics/Concepts Assessed

- | | |
|---|--|
| <ol style="list-style-type: none"> a. <u>Topographic Map</u> <ol style="list-style-type: none"> i. Map features ii. Map marginal information: location/series/scale/index/legend iii. Map symbols iv. Distances between features (English and Metric) v. Contours vi. Elevation of features and symbols vii. Direction of stream flow viii. Coordinate systems of map features with correct formats <ol style="list-style-type: none"> (1) Public Land Survey System (PLSS) (2) Sector Reference System (3) Latitude/Longitude in degrees, minutes, & seconds (4) Universal Transverse Mercator (UTM) ix. Azimuths and bearings x. Magnetic declination xi. Survey control marks (control stations and spot elevations) xii. Graticule tick marks / graticule intersections xiii. Topographic map profiles* | <ol style="list-style-type: none"> xiv. Slope (feet per 100 feet)* xv. Stream gradient (feet per 1000 feet)* <ol style="list-style-type: none"> b. <u>Highway Map</u>
<i>Topographic map topics may also be present on highway maps.</i> <ol style="list-style-type: none"> i. Map legend/tables/index ii. Map features/symbols iii. Map grid system iv. Distance between features v. City/Regional insets vi. Geographic coordinates in decimal degrees |
|---|--|

- c. Student-Created Map
 - i. Map scales
 - ii. USGS topographic map symbols and colors
 - iii. Distances
 - iv. Azimuths and bearings
 - v. Public Land Survey System
- d. Satellite Photos/Internet Maps
 - i. Feature identification
 - ii. Distances and scales
 - iii. Photo time-of-day identification
 - iv. Internet map symbols
 - v. Road travel between points

4. **SAMPLE QUESTIONS/TASKS:**

- a. Use the map index to identify the map coordinates of Cedarville.
- b. Use the Detroit inset map to compute the distance in miles and tenths along the roads from the Museum of Art to Cobo Arena.
- c. **What does it tell us if contour lines are very close together in an area?**
- d. **By observing shadows, estimate the time of day that this satellite image was captured.**

5. **SCORING:**

- a. High score wins. Values of questions may be weighted.
- b. Ties will be broken by the accuracy and quality of answers to pre-selected questions.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Road Scholar and Bio/Earth Science CDs; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Participants will be assessed on their understanding and evaluation of marine and estuary aquatic environments.

A TEAM OF UP TO: 2

EYE PROTECTION: C

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Each team may bring one 8.5" x 11" sheet of paper, which may be in a sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed, two stand-alone non-programmable, non-graphing calculators, and one participant-built salinometer/hydrometer for testing.
- b. Participants must wear eye protection during Salinometer Testing (3.Part IV.). Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows.

3. **THE COMPETITION:**

Scenarios and tasks will be drawn from marine and estuary locales (e.g., oceans, coral reefs, Chesapeake Bay) and scenarios and may require analysis, interpretation or use of charts, graphs and sample data as well as equipment use, collecting and interpreting data, measuring, analyzing data, and making inferences to evaluate comparative macroinvertebrates and water quality data.

Part I: Marine and Estuary Ecology – 30% of the total score

- a. This part will use multiple choice, matching, fill-in-the-blank and/or short answers to assess participants' knowledge.
- b. **Core knowledge areas may include** aquatic ecology, water cycle, nutrient cycling, aquatic chemistry and its implications for life, potable water treatment, waste water treatment, aquatic food chains/webs, community interactions, population dynamics **and the importance of watersheds.**
- c. **Additional applied topics may include: importance of estuaries,** watershed resource management issues, sedimentation pollution, harmful species, recently killed coral, **harmful algal blooms (HABs), emerging contaminants (e.g., medicines and chemicals like PFAS), and the five ocean garbage patches.**
- d. Division C - State and Nationals Only: life history strategies (e.g., age, structure, survival curves, life tables, succession, R and K strategies).

Part II: Coral Reef Macroflora and Fauna Identification – 30% of the total score

- a. This part will assess participants' knowledge of coral reefs and the ecological factors that have harmful effects on reef ecosystems. It will also include the identification (common name only) of Coral Reef organisms and their importance as indicators of reef health.
- b. Participants are also expected to know the general ecology, life cycles, and feeding habits of the following organisms (note: spp. is an abbreviation for multiple species):
 - i. Organisms found around the globe: Banded coral shrimp (*Stenopus hispidus*), Butterfly fish (*Chaetodon spp.*), Crown of thorns starfish (*Acanthaster planci*), Fleshy algae, Grouper >30 cm (Serranidae, Epinephelinae), Hard coral, Lobster, Long-spined black sea urchins (*Diadema spp.*), Moray eel (Muraenidae), Parrotfish (>20 cm) (Scaridae or Scarinae), Pencil urchin, Snapper (Lutjanidae), Sponge, Sweetlips (Haemulidae *Plectorhinchus spp.*), and Triton (*Charonia spp.*)
 - ii. Organisms found in the Indo-Pacific region only: Barramundi cod (*Cromileptes altivelis*), Bumphead parrotfish (*Bolbometopon muricatum*), Giant clams (*Tridacna spp.*), Humphead wrasse (*Cheilinus undulatus*), and Sea Cucumber
 - iii. Organisms found in the Atlantic region only: Flamingo Tongue Snail (*Cyphoma gibbosum*), Gorgonia, and Nassau grouper (*Epinephelus striatus*)

Part III: Water Monitoring and Analysis – 30% of the total score

- a. Participants are expected to understand and interpret data related to testing procedures and purposes for collecting data related to salinity, pH, phosphates, turbidity, dissolved oxygen, temperature, nitrates, fecal coliform, total solids, biochemical oxygen demand and aragonite saturation and their relationships to one another.
- b. No physical, laboratory tests will be performed on these topics by participants.



Part IV: Salinometer Testing – 10% of the total score

- a. Teams must build, calibrate, bring and demonstrate a salinometer/hydrometer capable of measuring saltwater (most likely NaCl) concentrations between 1-10% (mass/volume).
 - b. There are no restrictions on size except that the team must build the device to operate within a standard 400 – 600 mL beaker filled with at least 400 mL of the saltwater solution.
 - c. Teams will be expected to estimate the percent salinity measured by their device to the nearest tenth of a percent. Full credit will be given $\pm 1\%$ at Regionals and $\pm 0.5\%$ at State/Nationals. Calibration solutions may or may not be provided by the Event Supervisor.
4. **SCORING:**
- a. High score wins.
 - i. Points will be assigned to the various questions and problems for Parts I, II, and III.
 - ii. Points for bringing a salinometer for testing will be 5% of the total score.
 - iii. Points for making an accurate salinity measurement per 3.Part IV.c will be 5% of the total score.
 - b. Selected questions may be used as tiebreakers.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Water Quality/Marine and Estuary CD and Bio/Earth Science CDs; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** 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.

A TEAM OF: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. The participant who will be doing the writing must bring a writing utensil.
- b. No other materials or resources are allowed.

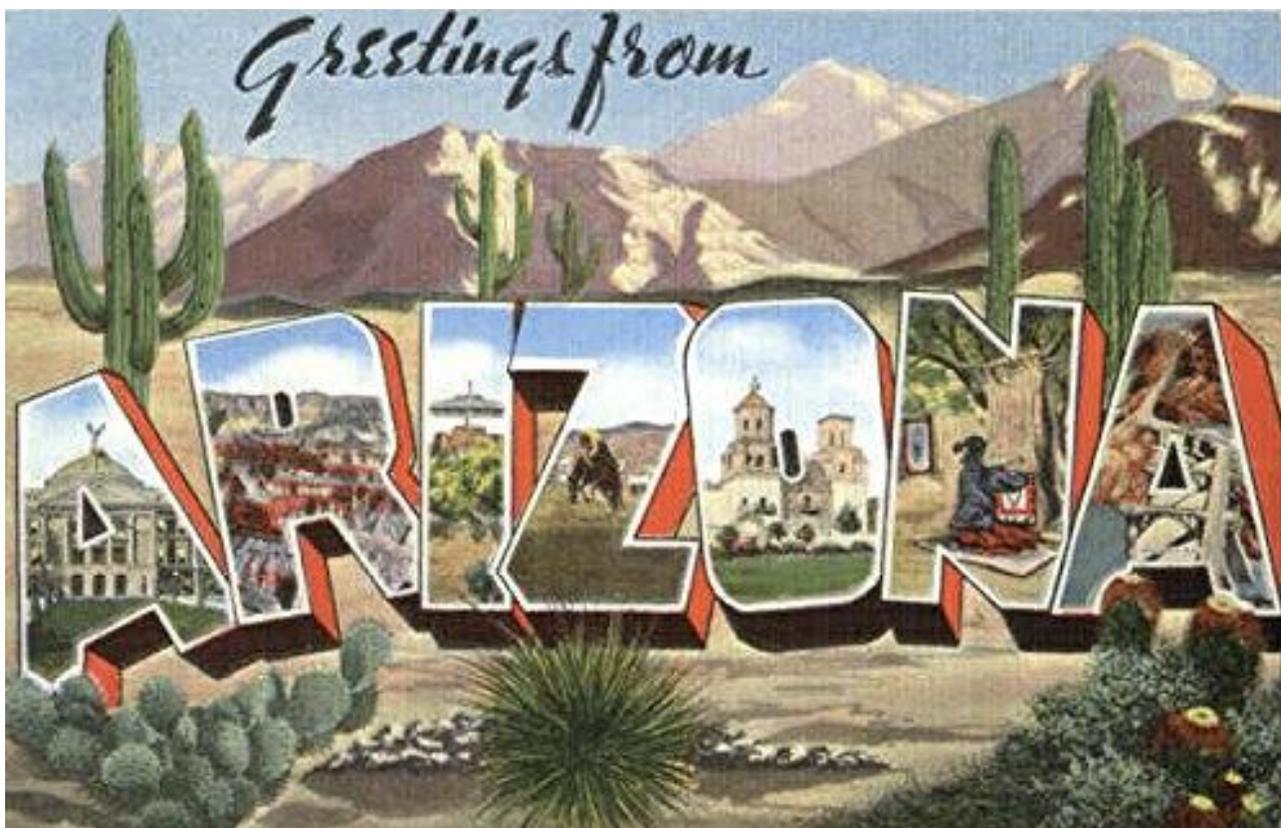
3. **THE COMPETITION:**

- a. One participant from each team is shown an object, which may be abstract but is the same for all teams, built from, but not limited to, such items as science materials, inexpensive materials (e.g., straws, push pins, Styrofoam balls, paper cups, Popsicle sticks, etc.) or commercial sets (e.g., K'nex, Tinker Toys, Lego, Lincoln Logs, etc.). This participant is not allowed to touch the object unless the Event Supervisor permits it.
- b. The participant viewing the object has twenty-five (25) minutes to write a description of the object and how to build it. There will be no advantage to finishing early.
- c. Drawings and diagrams of the model or subsections of the model are not allowed. Numerals, words and single letters that fit within the context of the written description are allowed. The participant may use abbreviations and do not have to define the abbreviation. Editing, punctuation, or scientific symbols that fit within the context of the written description are allowed.
- d. The Event Supervisor will pass the description to the second team member who will take the description and attempt to recreate (build) the original object in twenty (20) minutes.
- e. Supervisors will attempt to use different materials than the materials that were used last year.

4. **SCORING:**

- a. The team that builds the object nearest to the original and has a written description with no drawings or diagrams will be declared the winner.
- b. Each individual piece will receive points as applicable for: proper size, color, location, orientation, and/or connection.
- c. Pieces that are connected correctly beyond an incorrect connection will be counted in the score. No penalty will be assessed for parts that were not used.
- d. Students drawing a subsection of the model will be ranked in Tier 2. Drawing a picture of the model will result in disqualification.
- e. Time for the construction phase will be used as a tiebreaker.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Problem Solving/Technology CD; other resources are on the event page at soinc.org.



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Science Olympiad is continually in the process of researching, developing and evaluating new events. We are looking for events, activities and projects that engage students in all aspects of the scientific endeavor while presenting them with exciting and challenging problems to solve and content to master. In an effort to ensure our events meet those standards, we have established a process that moves an event from a creative concept through a series of pilots and trials, with the ultimate goal of making it into rotation as a current event.

For the 2020-2021 season, we are publishing a selection of Trial Events in the 2021 Rules Manual. The events presented here are not a comprehensive list of all the events under development. For a full list please visit: <https://www.soinc.org/learn/trial-events>. These particular events are being showcased here because of the topics they address, their approach to challenging Science Olympiad participants and their potential to become part of the competition in the next few seasons. Right now, they still need additional testing and trial. Besides being incorporated into this manual the rules for these events and additional resources are posted at <https://www.soinc.org/learn/trial-events>.

We have incorporated the rules for these Trial Events into the 2021 Rules Manual so that all teams, event supervisors, and tournaments have easy access to them. If conditions allow, we encourage State Chapters and Tournament hosts to run some of these Trial Events as they offer participants looking for an extra challenge the ability to compete against like-minded peers while contributing important information to prepare these events to become part of the competition in 2022 and beyond.

If a Tournament does choose to run one of the Trial Events published here, a Trial Event from the Trial Event page, or one of their own creation we would ask that you have both event participants and Event Supervisors complete the appropriate post-event evaluation. These evaluations can be found online at soinc.org on the Trial Event page. These brief surveys provide important information to help us fine tune events as well as make decisions about which events are worthy of being part of the Science Olympiad National Competition.



1. **DESCRIPTION:** At the Tournament, teams will assemble, test, and fly up to two aircraft built on-site without using adhesives from unopened standardized model airplane kits.

A TEAM OF UP TO: 2

IMPOUND: No

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- For Invitational and Regional competitions, teams must bring two unopened kits for inspection and their use. Only kits that, by design, are assembled without adhesives (i.e., Guillows Skystreak, AMA Alpha) and can be disassembled and reassembled to fly again will be accepted.
- At the State and National competitions, event supervisors will provide all airplane kits used in the event. Organizers will stipulate the airplane kit to be used in competition at least 2 weeks prior to the competition. Teams will choose two kits for the event from a selection of unopened standardized kits provided by the Event Supervisor. All teams must use the tournament provided standardized kit.
- Teams may bring up to 4 rubber motors, each not exceeding 2.0 grams.
- Teams may bring winders, assembly tools, fixtures (freestanding from airplanes), sandpaper, adhesive systems, thread, pins, tape, rubber O-rings for motors, clay and their logbook. All items must fit inside a single clear sided container with an approximate footprint of no more than 12" x 12".
- Teams must bring a first aid kit that should contain at least 3 adhesive band-aids and any other first aid equipment the team feels is necessary.
- Additionally, teams must bring cutting boards and wax paper to cover any and all work surfaces.
- The items in 2.e. and 2.f. do not need to be included in the above referenced (2.d.) tool box.
- Any team not using a cutting board will receive a 20% deduction on their final score.
- Each team is responsible for their work site. Any debris must be disposed of, the site cleaned and inspected before official flights are attempted.
- Teams will be allowed to attempt two (2) official flights for scoring.

3. **CONSTRUCTION PARAMETERS:**

- Only those materials found as part of the two kits will be allowed in model assembly. Glue, tape, pins or clay ballast may be added by teams and are considered as parts of each model.
- Boron, carbon fiber, extra wood or foam plastic materials are not allowed in the construction of the aircraft.
- The stock rubber motor may be replaced by other rubber elastic loops.
- Total mass without motor must be more than 10.0 grams and cannot exceed 25.0 grams.
- The wingspan cannot exceed 50.0 cm.
- Airplanes must use the propeller provided in the kit, which may not exceed 14.0 cm in diameter.
- Motors may have rubber O-rings and be lubricated after check-in.
- Airplanes will be labeled in such a way that can be identified by the participants in reference for their logbooks.

4. **THE COMPETITION:**

- The event will be held indoors. Tournament officials will announce the room dimensions (approx. length, width and ceiling height) in advance of the competition. Tournament Officials and Event Supervisors are urged to minimize the effects of environmental factors such as air currents. Rooms with minimal ceiling obstructions are preferred over very high ceilings.
- The event will be scheduled in hour time slots with no more than 10 teams competing in a time slot. The first 30 minutes will be devoted to complete primary check-in, model assembly and trim flights. The final 20 minutes will be to accomplish the team's two official flights. These flights will occur in 2-3 team mass launches within a 4-minute scheduled window.
- At their scheduled time a team will enter a cordoned off competition area to begin Primary Check-In, where they:
 - Sign-in and are scheduled, in sequence of their arrival, for an official flight time-slot, as well as receive from or have their model kits inspected by from the Event Supervisors depending upon the type of competition being held.



- ii. Teams will then submit their tools and materials kit (2.d.) as well as their first aid kit (2.e.) for inspection. Teams must show officials that they have at least a minimum of 3 adhesive band-aids as part of this kit or a 10% deduction will be applied to their final score.
 - iii. The team members remain in the competition area until their official flights are completed. No outside assistance is allowed.
 - iv. Teams will assemble up to two airplanes from the two kits and proceed to test/trim fly their models.
 - v. The first thirty minutes of the hour include check-in, model construction and flight trimming.
 - vi. At the Event Supervisor's Discretion:
 - (1) Test Flights may occur throughout the contest but will yield to official flights.
 - (2) Teams ready early can proceed to make their official flights in sequence.
 - (3) No Test Flights may occur in the last half hour of the event.
 - vii. A self-check inspection station may be made available to competitors for checking their airplanes prior to the Secondary Check-In for their Official Flights.
 - viii. Competitors may use any kind of winder, but electricity may not be available.
 - d. For Secondary Check-in and their Official Flight Time-Slot, teams must present up to two airplanes, their logbook, and up to 4 motors for inspection immediately prior to their Official Flight Time-Slot. Logbooks must describe at least 4 tasks that were used in either model construction or test flying their models prior to the competition. The logbooks may contain numerical data.
 - e. During Secondary Check-in, Timers will collect the motors presented for inspection. Allowable motors will be returned to the team just prior to their Official Flight Time-Slot.
 - f. After Secondary Check-in, teams will be taken in groups of 2 or 3 to make official flights:
 - i. Teams may make up to two (2) official flights using 1 or 2 airplanes.
 - ii. Teams will be instructed to put their airplanes on the floor then asked to pick them up.
 - iii. All motors that meet specifications and were collected during Secondary Check-in will be returned to the teams for their official flights.
 - iv. When picked-up, teams will have one minute to wind airplanes.
 - v. Timers will follow and observe teams as they are winding their motors.
 - vi. In the last 10 seconds of that minute, a timer will audibly announce the countdown. At "3-2-1 Launch!" all models in the group will be launched and timed independently.
 - vii. When the last model lands, teams will again be instructed to pick-up their models starting a one minute countdown for the second official flight. These flights will be timed to conclusion.
 - viii. Time aloft for each flight starts when the model leaves the competitor's hands and stops when any part of the model touches the floor, the lifting surfaces no longer support the weight of the model (such as the airplane landing on a girder or basketball hoop) or the Event Supervisors otherwise determine the flight is over.
 - ix. In an unlikely event of a collision, the two teams involved will re-fly the round.
 - x. Event Supervisors are strongly encouraged to utilize three (3) timers on all flights. The median flight time in seconds to the precision of the device used is the official time aloft.
5. **SCORING:**
- a. The final score is made by adding the two flight times together.
 - b. Ties will be broken by the longest single official flight time per team.
 - c. Teams with incomplete flight logs will have each flight time multiplied by 0.90.
 - d. Teams that worked without a cutting board will have each flight time multiplied by 0.80 after other penalties have been applied.
 - e. Teams without flight logs will have each flight time multiplied by 0.70.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Problem Solving/Technology CD which contains resources about building and flying airplanes; other resources may be found on the Trial Event page at soinc.org.



1. **DESCRIPTION:** Participants will demonstrate their knowledge of plant life and general botany principles.

A TEAM OF UP TO: 2

EYE PROTECTION: A

EVENT TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each participant may bring one 8.5" x 11" sheet of paper, which may be in sheet protector sealed by tape or laminated, that may contain information on both sides in any form and from any source without any annotations or labels affixed as well as a stand-alone, non-programmable, non-graphing calculator.
- Each participant must wear a lab coat and goggles when dealing with specimens.
- Event Supervisors will provide live/preserved specimens, pictures, tables, graphs of data, microscopes, slides, and any other required equipment for the event. If used, toxic/irritating plants or specimens in liquid (e.g., Algae, protists) must be in closed, non-breakable containers.

3. **THE COMPETITION:**

- This event may be run as either a sit-down exam or a series of laboratory stations with questions.
- Participants will be expected to master the structure of plant cells, roots, stems, leaves, spore forming bodies and flowers, aspects of plant growth and differentiation, and the transport and storage of gases, water, and nutrition throughout the plant body.
- Participants should also have a broad knowledge of the major divisions between groups of plants (i.e., algae vs. multicellular plants, monocot vs. dicot, embryophytes vs. cryptogams, woody vs. herbaceous plants).
- In addition to the above listed topics, participants should know:
 - The history of botany
 - Basic plant genetics and reproduction
 - Photosynthesis
 - Differences between the major taxonomic groups of plants
 - Paleo-botany and plant evolution
 - The role of plants in global energy and nutrient cycles
 - Use of plant materials by animals and humans
 - Competition in the plant community
 - Genetically Modified Organisms (GMOs)
 - Production of foodstuffs and plant products
 - Plant diseases; including nutrient deficiencies and infections
- For Division C Only, participants are expected to know:
 - Principles of horticulture and aquaculture
 - Plant biochemistry
 - The roles of plants in medicine and environmental management
 - Importance of plant diversity

4. **SAMPLE QUESTIONS/TASKS:**

- What leaf structure is being shown on this microscope slide?
- Using the graph, identify the peak wavelength for chlorophyll absorbance.
- Identify three key differences between flowering plants and ferns.
- Which plants would be in the next wave of plant succession for the region shown?
- Describe the role plants play in the nitrogen cycle.

5. **SCORING:**

- High Score wins.
- Selected questions will be used to break ties.

Recommended Resources: Resources for this event can be found on the event page at soinc.org.



1. **DESCRIPTION:** Teams will cryptanalyze and decode encrypted messages using cryptanalysis techniques for historical and modern advance ciphers.

TEAMS OF UP TO: 3

EVENT TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Teams must bring writing utensils and may bring up to three (3) stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators.
- No resource materials, except those provided by the Event Supervisor, may be used.
- The Event Supervisor will provide scratch paper for each team to use.

3. **THE COMPETITION:**

- This event consists of participants using cryptanalysis techniques and advanced ciphers to decrypt and encrypt messages on a written exam.
- All teams will begin the event simultaneously at the indication of the Event Supervisor.
- Teams must not open the exam packet nor write anything prior to the “start” signal, nor may they write anything after the “stop” signal.
- Participants are allowed to separate the pages of the test to be free to answer the questions in any order, working individually or in groups, attempting whichever of the questions seem right for them.
- The code types that may be used on the exam at Invitational and Regional competitions are as follows:
 - the Atbash Cipher (in English, not Hebrew)
 - the Caesar Cipher, also called a shift cipher.
 - Mono-alphabetic substitution using K1, K2, or random alphabets as defined by the American Cryptogram Association (ACA)
 - Aristocrats with a hint - messages with spaces included, and with a hint
 - Aristocrats - messages with spaces included, but without a hint
 - Aristocrats - messages with spaces and hints, but including spelling/grammar errors
 - Aristocrats - messages with spaces and including spelling/grammar errors but no hints
 - Patristocrats with a hint - messages with spaces removed, and with a hint
 - Patristocrats - messages with spaces removed, but without a hint
 - Affine cipher – encrypting plaintext or decrypting ciphertext given the a and b values.
 - the Vigenère Cipher – encrypting plaintext or decrypting ciphertext given a key.
 - the Baconian Cipher – decrypting ciphertext encoded with the a b values represented as one or more letters, glyphs, symbols, or character rendering variations (e.g., bold, underline, italic).
 - Xenocrypt - no more than one cryptogram can be in Spanish
 - the Pollux and Morbit Ciphers – decrypting Morse code ciphertext encoded as digits and spaces given the mapping of at least 6 of the digits.
 - The Rail Fence Cipher – decrypting transposed text given the number of rails.
- The code types that may be used on the exam at State and National competitions are as follows:
 - All Invitational and Regional code types
 - Xenocrypt - at the state and national levels, at least one cryptogram will be in Spanish.
 - Cryptanalysis of the Vigenère cipher with a “crib” of at least 5 plaintext characters
 - Cryptanalysis of the Affine Cipher with a “crib” of at least 2 plaintext characters.
 - Cryptanalysis of The Pollux and Morbit Ciphers with a “crib” of at least 4 plaintext characters
 - Cryptanalysis of The Rail Fence Cipher with a “crib” of at least 5 plaintext characters and a range for the rails.
- For aristocrats, patristocrats, and xenocrypts: no letter can ever decrypt to itself.
- No more than 2 cipher questions will be an encryption on the exam.
- The exam packet will include a resource sheet with the Morse Code Table, English/Spanish letter frequencies, Vigenère table, Baconian mapping and modulus inverse tables as needed for the questions on the exam.
- The first question of the exam will be timed.
 - The first question will be the decoding of an Aristocrat as defined by rules 3e.iii.(1) or 3.e.iii.(2).
 - A team member should signal when his or her team has broken the cryptogram.
 - Before the exam begins, the event supervisor will announce the nature of the signal that must be used (e.g., shouting “bingo”, or quietly raising hand).
 - The time in seconds, to the accuracy of the device used, to solve the cryptogram will be recorded by the event supervisor or designee.



- v. If a team gets the timed question wrong, they may attempt to answer the question repeatedly without penalty. The Timing Bonus will be calculated from the start of the event until the question is successfully answered by the team with two or fewer errors, or until 10 minutes has elapsed. After 10 minutes, the timed question can still be answered but the Timing Bonus is zero.

4. **SCORING:**

- a. The high score wins. Final score = Exam score + Timing Bonus.
- b. Based on difficulty of the question, correct answers for each question will earn a clearly indicated number of points.
- i. The general point distribution by question type is:
- (1) An “easy question” = 100-150 pts
 - (2) A “medium question” = 200-300 pts
 - (3) A “hard question” = 350-500 pts
 - (4) A “very hard question” = 550-700 pts
- ii. For questions such as cryptograms, with answers composed of letters, the final points will be determined based on the number of errors found.
- (1) Two or fewer errors will result in full credit
 - (2) Each additional error results in a penalty of 100 points
 - (3) The penalty will not exceed the value of the question. For example, a 400-point question with 5 errors is worth 100 points whereas the same 400-point question with 7 errors would be worth 0 points, not -100 points.
- iii. The scores for each question will be added to determine the exam score.
- c. A Timing Bonus can be earned based on the number of seconds it takes a team to correctly decode the first question. The Timing Bonus is equal to $4 \times (600 - \text{number of seconds})$ For example, 6 minutes = $4 \times (600 - 360) = 960$ points.
- d. Scoring example: Team A earns 3600 points on the exam and solves the timed question in 435 seconds.
- | | | |
|-----------------------------|---|-----------|
| Exam Score | = | 3600 pts. |
| + Timing Bonus $4(600-435)$ | = | 660 pts. |
| Final Score | | 4260 pts. |
- e. Tie Breakers: For teams that are tied, select questions predetermined by the event supervisor, will be used to break the tie using the following criteria in this order: score, degree of correctness and attempted.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Codebusters Video Download and the Problem Solving/Technology CD; other resources are on the event page at soinc.org.



1. **DESCRIPTION:** Prior to the tournament teams design, construct, and test free flight electric-powered monoplanes to achieve maximum time aloft.

A TEAM OF UP TO: 2

IMPOUND: No

EVENT TIME: 8 minutes

2. **EVENT PARAMETERS:**

- a. Teams may bring up to 2 airplanes, any tools, and their flight log.
- b. Event Supervisors must provide all measurement tools and timing devices.

3. **CONSTRUCTION PARAMETERS:**

- a. Airplanes may be constructed from published plans, commercial kits and/or a student's design. Kits must not contain any pre-glued joints or pre-covered surfaces.
- b. Any materials except Boron filaments may be used in construction of the airplane.
- c. Total mass of the airplane throughout the flight must be 7.0 g or more.
- d. The airplane must be a monoplane (one wing) and the horizontally projected wingspan must not exceed 40.0 cm. The maximum wing chord (straight line distance from leading edge of wing to trailing edge, parallel to the fuselage) of the wing is 6.0 cm. The maximum horizontally projected stabilizer span is 25.0 cm. The maximum allowable chord of the stabilizer is 5.0 cm.
- e. The propeller assembly may be built by the competitor(s) or purchased pre-assembled. It may include a propeller, a shaft, a hanger, and/or a thrust bearing. The propeller must be a single two-bladed propeller with a maximum diameter of 20.0 cm. Variable-pitch propellers that include mechanisms to actively change the blade diameter or angle must not be used.
- f. A capacitor not to exceed 3.0V, 5.0F must power a DC motor. The motor may either directly drive the propeller or be connected through a gear system. The capacitor must be charged with no more than 3.0V.
- g. The airplane(s) must be labeled in such a way as to be easily identified by the event supervisor. At least one non-horizontal surface on the airplane (such as a fin or dihedral panel) must be covered in a non-transparent, non-white material so it can be identified at its maximum altitude.
- h. Students must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org

4. **THE COMPETITION:**

- a. The event must be held indoors. Tournament officials must announce the room dimensions (approximate length, width and ceiling height) in advance of the competition. Tournament officials and the Event Supervisor are urged to minimize the effects of environmental factors such as air currents. Rooms with minimal ceiling obstructions are preferred over very high ceilings.
- b. Once competitors enter the cordoned off competition area to trim, practice, or compete they must not receive outside assistance, materials, or communication. Teams violating this rule must be ranked below all other teams. Spectators must be in a separate area.
- c. During inspection each team must present a flight log of recorded data. Data must include 6 or more parameters (3 required and at least 3 additional) for 10 or more test flights prior to the competition. The required parameters are: 1) Charging details for the capacitor 2) modifications from previous flights, 3) flight time. The team must choose 3 additional data parameters beyond those required (e.g. charge remaining after landing, estimated/recorded peak flight height, etc.).
- d. At the Event Supervisor's discretion:
 - i. Multiple official flights may occur simultaneously according to the Event Supervisor's direction.
 - ii. Test flights may occur throughout the contest but must yield to any official flight.
 - iii. No test flights will occur in the final half-hour of the event's last period, except for teams that declare a trim flight during their 8-minute flight period.
- e. A self-check inspection station may be made available to competitors for checking their airplanes prior to check-in with the Event Supervisor.
- f. Competitors must present their event materials (airplanes, motors, and logs) for inspection immediately prior to their 2 official flights. Timers must follow and observe teams as they are charging their capacitors.
- g. Teams may make up to a total of 2 official flights using 1 or 2 airplanes.



- h. After check-in teams must be given an 8-minute Flight Period, starting when their first flight (trim or official) begins. Any flight beginning within the 8-minute period will be permitted to fly to completion. Competitors may make adjustments/repairs/trim flights during their official 8-minute period. Before their launches, competitors must indicate to the Timers whether a flight is official or a trim flight. A flight is considered official if a team fails to notify Timer(s) of the flight's status. Teams must not be given extra time to recover or repair their airplanes.
 - i. Time Aloft for each flight starts when the airplane leaves the competitor's hand and stops when any part of the airplane touches the floor, the lifting surfaces no longer support the weight of the airplane (such as the airplane landing on a girder or basketball hoop) or the judges otherwise determine the flight to be over.
 - j. Event Supervisors are strongly encouraged to utilize 3 Timers on all flights. The median flight time in seconds to the precision of the device used, recorded by the 3 Timers, is the official time aloft.
 - k. Competitors must not steer the airplane during flight.
 - l. In the unlikely event of a collision with another airplane, a team may elect a re-flight. The decision to re-fly may be made after the airplane lands. Timers are allowed to delay a launch to avoid a possible collision. The eight-minute period does not apply to such a flight.
5. **SCORING:** The base score is the Team's longest single flight time. Ties will be broken by the longest non-scored official flight time.
- a. 10% of the flight time will be added to flight time of the airplane that has a colored panel on the wing that is at least the length of the wing chord and at least between 2 wing ribs.
 - b. Teams with incomplete flight logs must have 10% of their flight time deducted from each flight.
 - c. Teams without flight logs must have 30% of their flight time deducted from each flight.
 - d. Teams that violate a rule under "CONSTRUCTION" or "THE COMPETITION" that does not have a specific penalty must be ranked after all teams that do not violate those rules.

Recommended Resources: Reference and training resources including the Wright Stuff CD (WSCD) and the Wright Stuff DVD (PROD) are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>



1. **DESCRIPTION:** Participants will use their investigative skills in the scientific study of home horticulture.

A TEAM OF UP TO: 2

EYE PROTECTION: C

EVENT TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each team may bring one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during any part of the event.
- Each team may bring two stand-alone calculators of any type to use during the event.
- Each team must bring a soil test kit complete with chemicals to test soil samples for pH, N, P, and K.

3. **THE COMPETITION:**

- The competition will consist of a series of task that could include hands-on activities, questions on listed topics, interpretation of data (e.g., graphs, diagrams, and tables), or observation of an established and running experiment.
- Teams may be asked to analyze soil samples for pH, nitrogen, phosphorus, and/or potassium.
- Participants are expected to have knowledge of the following topics:
 - basic botany
 - plant propagation
 - soil health, fertilizer management, and composting
 - entomology of pests & pest management
 - plant diseases,
 - vegetables, tree fruit, & small fruit (e.g., blueberries, brambles, currants, gooseberries, grapes, & strawberries)
 - lawn care & pruning ornamentals,
 - woody ornamentals, herbaceous plants, and native plants
 - weeds and invasive plants
 - garden wildlife (e.g., butterflies, hummingbirds, bumble bees)
 - nuisance animals (e.g., chipmunks, cottontail rabbits, voles, raccoons, skunks, squirrels, deer, & woodchucks)
- English units will be used for all calculations as current horticulture literature uses English units exclusively.

4. **SAMPLE QUESTIONS/ACTIVITIES:**

- Use soil test kit to determine the soil pH.
- Calculate the amount of 10-10-10 fertilizer to use in a 100 ft² garden.
- Identify an herbaceous plant from a picture.
- Determine the spacing for woody plants in a garden bed given the mature size.
- Recall the difference between a warm season turfgrass and a cool season turfgrass.
- Identify an insect pest from a picture.

5. **SCORING:**

- Scoring will be split approximately 75% exam and 25% hands-on activities. High score wins.
- Time may be limited at each task but will not be used as a tiebreaker for scoring.
- Ties will be broken by pre-selected questions.
- A penalty of up to 10% may be given if the area is not cleaned up as instructed.
- A penalty of up to 10% may be given if a team brings prohibited equipment to the event.

Recommended Resources: Resources for this event can be found on the event page at soinc.org.



1. **DESCRIPTION:** Teams must construct a collecting device prior to the tournament that is designed to collect heat and complete a written test on alternative energy concepts.

A TEAM OF UP TO: 2

IMPOUND: No

APPROX. TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Each team may bring one three-ring binder of any size containing information in any form and from any source, attached using the available rings. Sheet protectors, lamination, tabs and labels are permitted. Participants may remove information or pages for their use during any part of the event.
- Each team may bring their heat collection device, an unaltered, glass or plastic, standard (height ~1.4 times the diameter) 250 mL beaker, copies of graphs and/or tables for scoring, tools, supplies, writing utensils, and two stand-alone calculators of any type for use during any part of the event.
- Event supervisors will supply the water, and thermometers or probes (recommended). Non-contact thermometers are allowed.
- Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

3. **CONSTRUCTION PARAMETERS:**

- Devices may be constructed of and contain any materials (e.g., cardboard, aluminum foil, reflective fabric or material, glue, tape, mirrors, tiles and lenses).
- The device, including beaker, must fit within a 35.0 cm x 35.0 cm x 35.0 cm cube when set up for testing.
- Within the device, participants must be able to insert and remove a beaker that they supply (see 2.b).
- The device must also easily accommodate the insertion and removal of a thermometer/probe into the beaker. Parts of the device may be inside the beaker, but the device must not contact the water.
- Devices will be inspected to ensure that there are no energy sources (e.g., no electrical components, small battery powered heaters, chemical reactions, etc.) to help warm the water. At the event supervisor's discretion, teams must disassemble their devices at the end of the testing period in order to verify the materials used in construction.
- All parts of the device must not be significantly different from room temperature at the start of the event.
- Prior to competition, teams must calibrate devices by preparing graphs/tables showing the relationship between elapsed time and water temperature. A labeled device diagram should be included.
 - Any number of graphs and/or data tables may be submitted but the team must indicate up to four to be used for the Chart Score, otherwise the first four provided are scored.
 - Graphs and/or tables may be computer generated or drawn by hand on graph paper. Each data series counts as a separate graph. A template is available at www.soinc.org.
 - Teams are encouraged to have a duplicate set to use, as those submitted may not be returned.

4. **THE COMPETITION:**

Part I: Written Test

- Teams will be given a minimum of 20 minutes to complete a written test consisting of multiple choice, true-false, completion, or calculation questions/problems.
- Unless otherwise requested, answers must be in metric units with appropriate significant figures.
- The competition must consist of at least five questions from each of the following areas:
 - Basic information and definitions about energy, work, heat and heat transfer, temperature, temperature scales, thermal energy and insulation.
 - General information about renewable energy including but not limited to solar, wind, hydroelectric, tidal, ocean thermal energy conversion (OTEC), and geothermal.
 - General information about energy conservation practices including but not limited to recycling, reusing, and using materials with greater efficiency.
 - Mathematical relationships and equations used in determining heat loss and gain, specific heat, and heat transfer.

Part II: Device Testing

- At the start of the competition block, teams will be given 5 minutes to set up or modify their devices and use their graphs and/or tables to calibrate them. Devices that do not meet the construction specs will not be allowed to be tested until brought into specification.



- b. At each station, the event supervisor will provide an incandescent lamp with a bell-shaped reflector. The lamp will be mounted, facing down, above the testing surface (on which teams will set up their device) such that the bottom of the bulb is at least 40.0 cm from the testing surface. Multiple identical stations may be used.
 - c. At the start of a team's device testing period the supervisor, using their own measuring device, will dispense 100 mL of water into the team's beaker. A team may elect to install the beaker in a device prior to this, but must leave sufficient access to the beaker. Otherwise the team may then place the beaker into their device.
 - d. Teams will use their graphs and/or tables to predict the temperature of the water in their beaker at the end of the 10-minute heating time. After receiving water, teams will be given at least 3, but no more than 5 minutes to make their final predictions. During this time, teams may use their own thermometers to measure the starting water temperature in their beaker, but after this time must remove them.
 - e. The supervisor will insert a probe/digital thermometer into the water to measure and record the initial temperature to the nearest tenth of a degree. Supervisors may leave thermometers/probes in the devices for the entire heating period, but will announce if they will do so before impound. Otherwise they will insert a thermometer/probe into the beaker in the device, wait at least 20 seconds, and record the resulting temperature. Multiple thermometers/probes may be used at the supervisor's discretion
 - f. The light source must be turned on and a stopwatch started. At the end of 10 minutes the light will be turned off and the thermometer/probe will be read and recorded to the nearest tenth of a degree to determine the gain in temperature.
 - g. The supervisor will review with the team the Part II data recorded on their scoresheet.
 - h. Teams filing an appeal regarding Part II must leave their device in the competition area.
5. **SCORING:**
- a. High score wins.
 - b. All scoring calculations are to be done in degrees Celsius.
 - c. Final Score (FS) = TS + CS + HS + PS; The maximum possible FS is 100 points. A scoring spreadsheet is available at www.soinc.org.
 - d. Test Score (TS) = (Part I score / Highest Part I score for all teams) x 50 points
 - e. Chart Score (CS): One of the submitted graphs/tables, selected by the Event Supervisor, is scored using i., ii., and iii., described below for a maximum of 6 points. Four (4) additional CS points are available via items iv. and v. Partial credit may be given. A device must be present to receive a CS.
 - i. 2 points for including data spanning at least one variable range
 - ii. 2 points for including at least 10 data points
 - iii. 2 points for proper labeling (e.g., title, team name, units)
 - iv. 0.5 points for each distinct graph or table turned in (up to 2 points total)
 - v. 2 points for including a labeled device diagram
 - f. Heat Score (HS) = (HRF / Highest HRF of all teams) x 15 points; HRF (Heat Retention Factor) = (final beaker water temp / starting beaker water temp)
 - g. Prediction Score (PS) = (PE / Highest PE of all teams) x 25 points; PE (Prediction Estimate) = $(1 - (\text{abs}(\text{final beaker water temp} - \text{predicted final beaker water temp}) / \text{final beaker water temp}))$. The minimum PS possible is 0 points.
 - h. If a team violates any COMPETITION rules, their HRF and PE values will be multiplied by 0.9 when calculating the scores.
 - i. If any CONSTRUCTION violation(s) are corrected during the Part II testing period the HRF and PE values will be multiplied by 0.7 when calculating the scores.
 - j. Teams that are disqualified for unsafe operation or do not bring a collecting device receive zero points for their HRF and PE scores. Teams will be allowed to compete in Part I.
 - k. Tie Breakers: 1st — Best TS; 2nd — Best HS; 3rd — Best PS



1. **DESCRIPTION:** 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.
A TEAM OF UP TO: 2 **EYE PROTECTION:** B **IMPOUND:** Yes **APPROX. TIME:** 10 minutes
2. **EVENT PARAMETERS:**
 - a. Prior to the competition teams must collect and record launch device performance and calibration data.
 - b. Each team may bring tools, supplies, writing utensils, and stand-alone calculators of any type for use (these items need not be impounded). Each team must impound only one launch device and design log. Items must be moveable by the competitors without outside assistance.
 - c. Event Supervisors will provide the projectiles, counterweights, and target.
 - d. Participants must wear eye protection during device setup and operation. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows.
 - e. Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.
3. **CONSTRUCTION PARAMETERS:**
 - a. When ready-to-launch, the launch device, projectiles, stabilizing weights, **counterweights**, and all other device components (except for tools / supplies) must fit in a 65.0 cm per side cube, in any orientation chosen by the team.
 - b. The triggering device is not considered part of the device and activating it must not contribute significant energy to the launch. It must extend out of the launch area, allow for competitors to remain at least 75cm away from the launch area, and does not need to return to the launch area after launch. The triggering device must not pose a danger due to flying parts or excessive movement outside of launch area.
 - c. The launch device must be constructed to accommodate the supervisor provided counterweights and projectiles (see Section 6 for details). Teams may not modify the counterweights or projectiles.
 - d. The launch force must be entirely supplied by the gravitational potential energy from the supervisor provided falling counterweights. The device, without the counterweight and projectile, must not contribute energy to the launch. This includes any part of the device whose potential energy decreases, with the exception of items of nominal mass, such as strings and thin rods. Devices will be inspected to ensure that there are no other energy sources. At the supervisor's discretion, teams must disassemble devices after competing in order to verify this. Example violations, allowable types, and mechanisms for testing for added energy are available on soinc.org.
 - e. The launch device must be designed and operated in such a way to not damage or alter the floor.
 - f. Electrical components are not allowed as part of the device or triggering device.
4. **DESIGN LOG:**
 - a. Teams must submit a design log showing collected device data, which should contain:
 - i. One or more photos and/or diagrams of the device with labels identifying all the major components and detailing their function, along with a brief summary of how the device was built.
 - ii. Any number of graphs and/or tables showing the relationship between various parameters such as arm position or projectile mass and impact position. Graphs/tables may be computer generated or hand drawn on graph paper. Each data series counts as a separate graph. A template is at www.soinc.org.
 - iii. Example calculations showing how to use the graphs/tables to adjust the device for a target position.
 - b. The team must indicate up to four graphs/tables to be scored, otherwise the first four provided are scored.
 - c. All pages of the design log must be affixed together, such as via three ring binder, staples, or paperclips.
 - d. Design logs will be returned to the team after they are done competing.
5. **THE COMPETITION:**
 - a. Each team will have 8 minutes to set up, adjust and calibrate their device, and to launch a max of 2 shots with each counterweight. Measurement time required by the supervisor is not included in the allotted time. Devices that do not meet the construction specs will not be allowed to launch until brought into spec.
 - b. When instructed by the event supervisor(s), teams must place their device at a location they select in the launch area. Competitors must not be within 75 cm of the launch area or in front of the front edge of the launch area during a launch. They may touch only the part of the triggering device that extends at least 75cm outside of the launch area.
 - c. Teams may move devices within the launch area and/or adjust them in any way between and before shots.



- d. No part of the launch device may extend outside of the launch area before or after a shot. If part of the launching device extends beyond the launch area during the launching action, it must return to and remain in the launch area immediately after the launch without assistance of the competitors.
 - e. Before the first launch with each counterweight, the team must notify the supervisor of the desired position of the target (only 0.5 m increments allowed).
 - f. Before each launch, teams must notify the event supervisor. Any launch, even if unintended or not announced, will count as one of the four launches allowed to a team.
 - g. If the team tries to trigger the device and it does not go through a launch motion, it does not count as one of the team's four launches and the team must be allowed to adjust/reset the device if time allows.
 - h. After each launch the event supervisor will indicate to the team when they may approach the target to make measurements to calibrate their device.
 - i. If a team hits the target, they may request the target be moved to a new location (in 0.5 m increments).
 - j. Supervisors must be responsible for retrieving projectiles and returning them to the team between each launch if less than 2 projectiles of each type are initially provided to the team.
 - k. The supervisor will review with the team the data recorded on their scoresheet.
 - l. Teams who wish to file an appeal must leave their device and design log with the event supervisor.
6. **COMPETITION AREA:**
- a. The launch area is a rectangular area 1.0m wide by 1.0m long (parallel to the launch direction), designated by tape on the floor. Tape must also be placed 75cm away from the sides and back of the launch area. Supervisors are recommended to use hard surfaces for the floor (e.g., concrete, hardwood, plywood).
 - b. The target will be an open-topped container with a minimum dimension of 20 cm x 20 cm x 20 cm.
 - c. The supervisor will set the target at a distance selected by the team so that two sides of the target are parallel with a straight line from the center of the Launch Area to the center of the target.
 - d. The 2 separate counterweights must consist of a 0.5-1.5 kg (light) or 1.5-2.5 kg (heavy) mass with a standard 1" open hook bolt on top. Each hook and counterweight together must fit inside a 15.0 cm cube.
 - e. Projectiles must have a mass of 20.0-40.0 g (for the light counterweight) and 40.0-60.0 g (for the heavy counterweight) and must be approximately spherical with a diameter not exceeding 6.0 cm. Dangerous projectiles must be avoided. If multiple projectiles are used, they must be similar in size, shape, and mass.
 - f. Target, counterweight, and projectile dimensions and specifications must be announced only after impound is over and must be the same for all teams.
7. **SCORING:** A scoring spreadsheet is available at www.soinc.org
- a. High score wins. Final Score = Best Light LS + Best Heavy LS + CS.
 - b. Launch Score (LS) = $TD - 3 \times AS + B$. Lowest possible LS is 0
 - c. Target Distance (TD) = distance, in cm, from the center of the front of the launch area to the target center.
 - d. Accuracy Score (AS) = straight line distance, in cm, from the projectile initial impact location to the target
 - i. Eligible impact locations include the floor, wall, support column, target, or other objects. The ceiling and objects affixed to or hanging from it are not eligible impact locations. Shots with projectiles hitting such areas will use the next eligible impact location contacted by the projectile.
 - ii. If the projectile hits the target on initial impact AS = 0.
 - e. Bonus (B) = Hitting the target at first impact is worth 0.15 x TD points. Making contact with the inside bottom surface is worth an additional 0.15 x TD points (for a total of 0.30 X TD points).
 - f. Chart Score (CS) - One of the submitted graphs and/or tables, selected by the event supervisor, must be scored per items i., ii. and iii. below. Partial credit may be given. Max possible CS is 40.
 - i. 6 points for including data spanning at least one variable range listed in 4.a.ii.
 - ii. **6 points for including at least 10 data points in each data series**
 - iii. 6 points for proper labeling (e.g., title, team name, units)
 - iv. 3 points for each graph or table turned in (up to 12 points total as long as they are not the same)
 - v. 5 points for including a labeled device picture or diagram
 - vi. 5 points for including at least 2 example calculations
 - g. If a team violates any THE COMPETITION rules, their LS scores will be multiplied by 0.9.
 - h. If any CONSTRUCTION PARAMETERS violation(s) are corrected during the allotted competition period, or if the team misses impound, their LS scores will be multiplied by 0.7.
 - i. Teams disqualified for unsafe operation or that do not having a device that is brought into specs during the allotted competition period will have LS scores of 0.
 - j. Participants will be informed before the next launch if they have received a penalty.
 - k. Tiebreakers: 1st: best LS; 2nd second best LS; 3rd third best LS



CHEMISTRY RECOMMENDED LAB EQUIP.

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

Each team may bring any or all of the items listed below for use in Division B Chemistry Events. Teams not bringing these items will be at a disadvantage as Event Supervisors will not provide Recommended Lab Equipment. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

Item & Expected Use	Likely to be used in:			
	Crime Busters	Can't Judge a Powder	Food Science	Potions and Poisons
Box - Containing all of the kit materials	X	X	X	X
10 ml Graduated Cylinder - Measuring volumes		X	X	X
25 ml Graduated Cylinder - Measuring volumes		X	X	X
100 ml Graduated Cylinder - Measuring volumes		X	X	X
50 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
100 ml Beakers - Doing reactions, developing chromatograms		X	X	X
250 ml Beakers - Doing reactions, developing chromatograms		X	X	X
400 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
50 ml Erlenmeyer Flasks - Doing reactions		X	X	X
125 ml Erlenmeyer Flasks - Doing reactions		X	X	X
250 ml Erlenmeyer Flasks - Doing reactions		X	X	X
Test Tubes - Mix Chemicals, heat chemicals	X	X	X	X
Test Tube Brush - Clean Test Tubes	X	X	X	X
Test Tube Holder - Holds test tubes for heating	X	X	X	X
Test Tube Rack - Hold Test Tubes	X	X	X	X
Petri Dishes - Doing reactions, developing chromatograms	X	X	X	X
Spot Plates - Doing reactions in semi-micro scale, testing solubility, pH	X	X	X	X
Slides - To put hairs, crystals, or fibers on for use with a microscope	X			
Cover Slips - To prevent items from coming off slides	X			
Droppers - Add small amounts of liquids to reactions	X	X	X	X
Spatulas or spoons - Getting small amounts of solids out of containers	X	X	X	X
Stirring Rods - Stirring mixtures	X	X	X	X
Thermometer - Determining the temperature of a solution		X	X	X
Metal Tongs, Forceps, or Tweezers - Holding objects, retrieving objects from liquids	X	X	X	X
pH or Litmus paper - Test acidity or alkalinity of solution	X	X	X	X
Hand Lens - Magnification of small items for identification	X	X		
9V or less Battery Conductivity Tester - Determining ionic strength of solution		X	X	X
Paper Towels - Cleaning	X	X	X	X
Pencil - Writing, Marking Chromatogram	X	X	X	X
Ruler - Measuring lengths	X	X	X	X
Magnets - For extraction and identification of iron filings	X	X	X	X

The following document was prepared to offer some guidance to teams as they select calculators for use in different Science Olympiad events. By no means are the calculators listed here inclusive of all possible calculators; instead they are offered as common examples. The decisions of the event supervisors will be final.

Class I - Stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators

are the most basic type of calculators and often look like the one shown to the right. These calculators are limited to the four basic mathematics functions and sometimes square roots. These calculators can often be found at dollar stores.



Class II - Stand-alone non-programmable, non-graphing calculators look like the calculator to the right or simpler. There are hundreds of calculators in this category but some common examples include: CASIO FX-260, Sharp EL-501, and TI-30X.



Class III- Stand-alone, programmable, graphing calculators and stand-alone non-graphing, programmable calculators, often look like the calculator shown on the right. Some examples are: Casio 975 0/9850/9860, HP 40/50/PRIME, and TI 83/84/89/NSPIRE/VOYAGE.

To identify a stand-alone non-graphing, programmable calculators Are look for the presence of the 'EXE' button, the 'Prog' button, or a 'file' button. Examples include but are not limited to: Casio Super FXs, numerous older Casio models, and HP 35S. A calculator of this type with the buttons labeled is shown to the right.



PROG Button

EXE Button



Class IV - Calculator applications on multipurpose devices (e.g., laptop, phone, tablet, watch) are not allowed unless expressly permitted in the event rule.





CALCULATOR AND EVENTS MATRIX

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

Events	Type of Calculator Allowed				
	None	Class I	Class II	Class III	Class IV
Anatomy & Physiology		X	X		
Boomilever	X				
Circuit Lab		X	X	X	
Crime Busters	X				
Density Lab		X	X	X	
Disease Detectives		X	X		
Dynamic Planet		X	X	X	
Elastic Launched Glider		X	X	X	
Experimental Design		X	X		
Food Science		X	X		
Fossils	X				
Game On	X				
Heredity		X	X		
Machines		X	X	X	
Meteorology		X	X	X	
Mission Possible	X				
Mousetrap Vehicle		X	X	X	
Ornithology	X				
Ping Pong Parachute	X				
Reach for the Stars		X	X		
Road Scholar		X	X		
Water Quality		X	X		
Write It Do It	X				
Trial Events					
Aerial Scramble	X				
Awesome Aquifers	X				
Botany		X	X		
Codebusters		X			
Electric Wright Stuff	X				
Home Horticulture		X	X	X	
Solar Power		X	X	X	
Storm the Castle		X	X	X	



EYE PROTECTION GUIDE

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

This resource was created to help teams comply with the Science Olympiad Policy on Eye Protection adopted on July 29, 2015 and posted on the Science Olympiad Website (soinc.org).

Participant/Coach Responsibilities: Participants are responsible for providing their own protective eyewear. Science Olympiad is unable to determine the degree of hazard presented by equipment, materials and devices brought by the teams. Coaches must ensure the eye protection participants bring is adequate for the hazard. All protective eyewear must bear the manufacturer's mark Z87. At a tournament, teams without adequate eye protection will be given a chance to obtain eye protection if their assigned time permits. If required by the event, participants will not be allowed to compete without adequate eye protection. This is **non-negotiable**.

Corresponding Standards: Protective eyewear used in Science Olympiad must be manufactured to meet the American National Standards Institute (ANSI) standard applicable at its time of manufacture. The current standard is ANSI/ISEA Z87.1-2015. Competitors, coaches and event supervisors are not required to acquire a copy of the standard. The information in this document is sufficient to comply with current standards. Water is not a hazardous liquid and its use does not require protective eyewear unless it is under pressure or substances that create a hazard are added.

Compliant Eyewear Categories: If an event requires eye protection, the rules will identify one of these three categories. Compliance is simple as ABC:

CATEGORY A

- **Description:** Non-impact protection. They provide basic particle protection only
- **Corresponding ANSI designation/required marking:** Z87
- **Examples:** Safety glasses; Safety spectacles with side shields; and Particle protection goggles (these seal tightly to the face completely around the eyes and have direct vents around the sides, consisting of several small holes or a screen that can be seen through in a straight line)

CATEGORY B

- **Description:** Impact protection. They provide protection from a high inertia particle hazard (high mass or velocity)
- **Corresponding ANSI designation/required marking:** Z87+
- **Example:** High impact safety goggles

CATEGORY C

- **Description:** Indirect vent chemical/splash protection goggles. These seal tightly to the face completely around the eyes and have indirect vents constructed so that liquids do not have a direct path into the eye (or no vents at all). If you are able to see through the vent holes from one side to the other, they are NOT indirect vents
- **Corresponding ANSI designation/required marking:** Z87 (followed by D3 is the most modern designation but, it is not a requirement)
- **Example:** Indirect vent chemical/splash protection goggles

Examples of Non-Compliant Eyewear:

- Face shields/visors are secondary protective devices and are not approved in lieu of the primary eye protection devices below regardless of the type of vents they have.
- Prescription Glasses containing safety glass should not be confused with safety spectacles. "Safety glass" indicates the glass is made to minimize shattering when it breaks. Unless these glasses bear the Z87 mark they are not approved for use.

Notes:

1. A goggle that bears the Z87+ mark and is an indirect vent chemical/splash protection goggle will qualify for all three Categories A, B & C
2. VisorGogs do not seal completely to the face, but are acceptable as indirect vent chemical/splash protection goggles

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Doing Good for Others, Together

- Double Good has provided Science Olympiad with a grant to create the first Science Olympiad program for kids with disabilities.





See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

Looking for More Science Olympiad? Want an *INDIVIDUAL* Challenge?

CHECK OUT



Science Olympiad's new 9-month, calendar-based set of supports to keep you engaged in Science Olympiad at home, at school and afterschool.

Each themed month will contain free resources like Lesson Plans for popular Science Olympiad events you can use at home or at school; Science Olympiad STEM Sessions, webinars and interviews with leading experts in the field about careers and workforce; and the option to participate in STEM Showdowns, national-level, online Science Olympiad tests you'll take in real time to gauge your knowledge against your peers, complete with prizes and a national monthly leaderboard. **MY SO** can be used as a standalone or to support any regular Science Olympiad season.

LESSON PLAN <small>(First day of the month)</small> STEM SESSION <small>(15th day of the month)</small> STEM SHOWDOWN <small>(Last Thursday of the month)</small>	SEPTEMBER 2020 <table border="1"> <tr><th>Su</th><th>Mo</th><th>Tu</th><th>We</th><th>Th</th><th>Fr</th><th>Sa</th></tr> <tr><td></td><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr> <tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr> <tr><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td></tr> <tr><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td></tr> <tr><td>27</td><td>28</td><td>29</td><td>30</td><td></td><td></td><td></td></tr> </table> EPIDEMIOLOGY	Su	Mo	Tu	We	Th	Fr	Sa			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				OCTOBER 2020 <table border="1"> <tr><th>Su</th><th>Mo</th><th>Tu</th><th>We</th><th>Th</th><th>Fr</th><th>Sa</th></tr> <tr><td></td><td></td><td></td><td></td><td>1</td><td>2</td><td>3</td></tr> <tr><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr> <tr><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td></tr> <tr><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td></tr> </table> SPACE	Su	Mo	Tu	We	Th	Fr	Sa					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	NOVEMBER 2020 <table border="1"> <tr><th>Su</th><th>Mo</th><th>Tu</th><th>We</th><th>Th</th><th>Fr</th><th>Sa</th></tr> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr> <tr><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td></tr> <tr><td>15</td><td>16</td><td>17</td><td>18</td><td>19*</td><td>20</td><td>21</td></tr> <tr><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td></tr> <tr><td>29</td><td>30</td><td></td><td></td><td></td><td></td><td></td></tr> </table> CIRCUITS	Su	Mo	Tu	We	Th	Fr	Sa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19*	20	21	22	23	24	25	26	27	28	29	30											
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**2020-2021
ACADEMIC YEAR**

*The November and December dates of the STEM Showdowns have been adjusted to avoid holidays on 11/26, 12/24 and 12/31

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Visit soinc.org/MYSO to sign up or learn more.



NATIONAL TOURNAMENT SCHEDULE

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

2021 Division B National Tournament Schedule at Arizona State University; Tempe, Arizona Saturday, May 22, 2021

Event	7:00 – 8:00 AM	8:15 - 9:15 AM	9:30 - 10:30 AM	10:45- 11:45 AM	12:00 – 1:00 PM	1:15 - 2:15 PM	2:30 - 3:30 PM	7:30– 9:30 PM	
Anatomy & Physiology		1-10	11-20	21-30	31-40	41-50	51-60	Closing Ceremony	
Boomilever		Self-Schedule							
Circuit Lab		1-10	11-20	21-30	31-40	41-50	51-60		
Crime Busters		51-60	1-10	11-20	21-30	31-40	41-50		
Density Lab		11-20	21-30	31-40	41-50	51-60	1-10		
Disease Detectives		41-50	51-60	1-10	11-20	21-30	31-40		
Dynamic Planet		31-40	41-50	51-60	1-10	11-20	21-30		
Elastic Launched Glider		Self-Schedule							
Experimental Design		51-60	1-10	11-20	21-30	31-40	41-50		
Food Science		21-30	31-40	41-50	51-60	1-10	11-20		
Fossils		11-20	21-30	31-40	41-50	51-60	1-10		
Game On		21-30	31-40	41-50	51-60	1-10	11-20		
Heredity		31-40	41-50	51-60	1-10	11-20	21-30		
Machines		Impound	31-40	41-50	51-60	1-10	11-20		21-30
Meteorology			41-50	51-60	1-10	11-20	21-30		31-40
Mission Possible		Impound	Self-Schedule						
Mousetrap Vehicle	Impound	Self-Schedule							
Ornithology		51-60	1-10	11-20	21-30	31-40	41-50		
Ping Pong Parachute		Self-Schedule							
Reach for the Stars		21-30	31-40	41-50	51-60	1-10	11-20		
Road Scholar		1-10	11-20	21-30	31-40	41-50	51-60		
Water Quality		11-20	21-30	31-40	41-50	51-60	1-10		
Write It, Do It		41-50	51-60	1-10	11-20	21-30	31-40		



Science Olympiad

2021 National Tournament at
Arizona State University



Exploring the World of Science



Exploring the World of Science

Science Olympiad wishes to acknowledge the following business, government and education leaders for partnering with our organization. Working together, we can increase global competitiveness, improve science and technology literacy and prepare the STEM workforce of the future. Thanks to: Arizona State University (2021 National Tournament Host), North Carolina State University (2020 National Tournament Host), ArcelorMittal, NASA's Universe of Learning Astrophysics STEM Learning and Literacy Network, Ward's Science, Lockheed Martin, Combined Federal Campaign, Corteva Agriscience, NBC Universal Foundation, Google, Kinder Morgan Foundation, ACE Hardware, Discovery Education 3M Young Scientist Challenge, Double Good Foundation, Institute of Electrical and Electronics Engineers (IEEE), North American Association for Environmental Education (NAAEE), National Oceanic and Atmospheric Administration (NOAA), Potbelly Sandwich Works, Texas Instruments, VWR Foundation, Investing in Communities, SkyCiv and Yale Young Global Scholars. Strategic Partners: Code.org, Hardware Science, Japan Science and Technology Agency, mHUB, Million Women Mentors (MWM), MxD (The Digital Manufacturing Institute) and Milwaukee School of Engineering (MSOE).

See the Science Olympiad website: www.soinc.org for current information regarding Policies, Standards, Summer Institutes, Official Kits from Ward's Science and print plus digital items in the Science Olympiad Store

Science Olympiad
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