



Exploring the World of Science

Division B Rules Manual

Division B (Gr. 6-9)

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WELCOME TO THE 2020 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 2020 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 2020 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 SOVIP2019. Don't wait! This limited-time offer ends 12/31/19.



Science Olympiad Store: 866-312-3999
Ward's Science: 800-962-2660





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**.
- Coaches: Please remember to register early for the Science Olympiad Summer Institute – it sold out last year!
- 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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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) 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, rules 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.



ANATOMY & PHYSIOLOGY

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

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 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: burns, allergies to allergens (i.e., poison ivy, metals), infections (i.e., boils, carbuncles, athlete's foot, impetigo) and skin cancer
- v. **National Tournament Only:**
 - (1) Additional disorders: Psoriasis, human papilloma virus (HPV), other types of dermatitis & scabies
 - (2) Treatments and/or prevention for all conditions listed above (drugs, surgery, etc.)

- 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
- viii. The effects of exercise and aging on the skeletal system and the diseases mentioned
- ix. **National Tournament Only:**
 - (1) Additional diseases/disorders: spinal stenosis, achondroplasia, juvenile rheumatoid arthritis, spinal fractures, ankylosing spondylitis, and osteosarcoma
 - (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. Location and identification, including origin, insertion, and function, of the major skeletal muscles of the body listed on the **2020 Science Olympiad Major Skeletal Muscle List**
- vii. Exercise and aging effects on the cellular and gross anatomical structures of the muscular system
- viii. Muscle and tendon injuries and their prevention (i.e., strains and sprains)
- ix. The diseases on each level from the cell to the whole person as listed: Poliomyelitis, Muscular Dystrophies, Myasthenia gravis, tetanus, myositis



ANATOMY & PHYSIOLOGY CONT.

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

x. **National Tournament Only:**

- (1) Kinds of muscle contraction
- (2) Classes of muscle fibers and their functions
- (3) Cardiac and smooth muscle roles in the body
- (4) Role of the nervous system in muscle function
- (5) Muscle sensory systems (e.g., spindles and Golgi tendon organs)
- (6) Additional diseases: Carpal Tunnel Syndrome, Botulism, Fibromyalgia, and Chronic fatigue syndrome
- (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.

2020 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
Infraspinatus
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 intermedium
Vastus medialis
Tibialis anterior
Gastrocnemius
Soleus
Peroneus longus
Peroneus brevis



BOOMILEVER

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

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 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 and adhesive. Wood may never be painted, 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**. 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.

- 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 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.**
 - 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
 - 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 $\frac{1}{2}$ " dowel approximately 18 inches long with a spring-type door stop screwed into one end. Refer to example on www.soinc.org.



BOOMILEVER (CONT.)

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

6. **SCORING:**

- a. High score wins. $\text{Score} = \text{Load Score (g)} / \text{Mass of Boomilever (g)}$.
- 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



CIRCUIT LAB

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

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 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.
- 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 2H₂O (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



DENSITY LAB

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

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 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.



DISEASE DETECTIVES

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

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

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

Part II: Outbreak Investigation

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

Part III: Patterns, Control, and Prevention

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

4. **SCORING:**

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

This event is sponsored by Centers for Disease Control (CDC)



DYNAMIC PLANET

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

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)

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

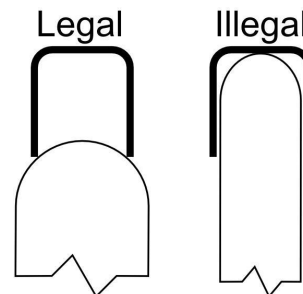
A TEAM OF UP TO: 2 EYE PROTECTION: B IMPOUND: No APPROXIMATE TIME: 6 minutes

2. **EVENT PARAMETERS:**

- a. Teams may bring up to 2 gliders for final inspection, flight log(s), any tools, and two stand-alone calculators of any type.
- b. 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.
- c. Event Supervisors will provide all measurement tools and timing devices.

3. **CONSTRUCTION PARAMETERS:**

- a. Gliders may be constructed from published plan(s), commercial kits and/or student designs.
- b. Participants must not use any components with pre-glued joints or pre-covered surfaces.
- c. 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.
- d. The functional components may be attached to each other using tape, thread and/or glue.
- e. The mass of the glider throughout the flight must be more than **3.0 g** and less than **10.0 g**.
- f. Wingspan must not exceed **28 cm** at any time.
- g. 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.
- h. 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.
- i. Each glider must be labeled so the Event Supervisor can easily identify the team to which it belongs.
- j. **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:**

- 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.
- b. 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.
- c. 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.).
- d. At the Event Supervisor's discretion:
 - i. multiple official flights may occur simultaneously;
 - ii. test flights may occur throughout the contest but must yield to any official flight; and,
 - 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 5-minute flight period.
- e. 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.
- f. 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.



EXPERIMENTAL DESIGN

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

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.

2020 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 500 mL beaker filled with at least 400 mL of saltwater solution.



FOOD SCIENCE (CONT.)

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

- 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**



FOSSILS (CONT.)

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

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.



FOSSIL LIST

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

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 Scleratinia (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*

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



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. sapien*
- 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



GAME ON

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

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 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:**

- a. This event may be run at stations and could include process skills such as data analysis, predictions, calculations, inferences, and observations.
- b. 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.
- c. 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
Mitosis, Meiosis and gamete formation	Transcription and translation	Multifactorial traits and Epistasis
Human karyotypes analysis for nondisjunction disorders	Co-dominance & incomplete dominance	PCR

4. **SAMPLE QUESTIONS:**

- a. 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?
- b. 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.
- c. A man who is blood type AB marries a woman who is blood type O. What blood types might be present in their children?
- d. Examine a pedigree and answer questions about sex of individuals, relationships, phenotype, and genotypes.
- e. Examine a karyotype and answer questions about sex of the individual, number of chromosomes, monosomy, trisomy, and genetic disorders.
- f. Examine data and/or diagrams concerning mitosis, meiosis, or DNA structure/replication and answer questions about the processes.

5. **SCORING:**

- a. Highest number of correct solutions will determine the winner.
- b. 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



MACHINES

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

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 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. The masses, 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. Masses A, B, and C must be between 20.0 and 800.0 g. The ratio of the largest mass to the smallest 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).
 - 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 in series 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.

- c. The test will consist of at least three questions from each of the following areas:

	Division B	Division C
Concepts, e.g., types and terminology	Simple machines only	Simple and compound machines
Calculations	Ideal and actual mechanical advantage, efficiency, load, and effort as applied to simple machines	Division B topics extended to include compound machines, plus potential and kinetic energy and coefficient of friction

- d. Questions are limited to the following simple machines (or, in Division C, combinations thereof) in static equilibrium and must include at least five of the following topics:

- i. Lever (all three classes)
- ii. Inclined plane
- iii. Wedge
- iv. Wheel and axle (including gears)
- v. Pulleys
- vi. Division C Only: Screw

- e. Topics prohibited in either division: Dynamic calculations, material strength, and angle of repose.

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.
- 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.



MACHINES (CONT.)

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

- 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.



METEOROLOGY

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

1. **DESCRIPTION:** Teams will display their understanding of meteorological principles associated with **severe weather** through an analysis & interpretation of 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 non-programmable, non-graphing** calculators and **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 and 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 waves, atmospheric stability, and boundaries (i.e.; fronts & drylines).
- Thunderstorms (such as air mass, multicell & supercell), life cycles, characteristics & structure
- Identification & interpretation of cloud types and characteristics associated with severe weather events
- Precipitation from severe storms: snow, hail, freezing rain/drizzle & rain and impacts of heavy precipitation, such as debris flow, mudslide, flash, river & urban flooding
- Squall lines & mesoscale convective complexes
- Straight line winds, katabatic winds, downdrafts, downbursts, gust fronts, micro & macrobursts, derechos & dust storms
- 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 (a. – j.)
- Observation technologies, including high-resolution surface-based station networks (e.g., mesonets), buoys, aircraft, satellite (particularly water vapor, visible & IR) imagery, Doppler radar & radiosondes
- Data and information 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 (e.g., hail, flooding, winds, storm surges, avalanches, tornado outbreak)
- Severe Weather Special Topics, Events and Cases: Hurricanes - Florence, Harvey, Irma, Maria, Michael & any major hurricanes in 2019, U.S. Blizzards of 2019 & 2020, Midwest & Other Floods of 2019, Tornado Outbreaks of 2018 & 2019.

4. **SAMPLE QUESTIONS/TASKS:**

- Use surface and upper air maps to determine the most likely location of a severe weather.
- Analyze storm damage, Doppler radar and satellite images relating to severe storms
- 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 (e.g., hurricanes, storm surges and straight-line damage from derechos vs. tornadic damage patterns)
- 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)



MISSION POSSIBLE

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

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.
- 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 (½ 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 (except the golf ball in the Start and Final Actions).
 - 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, gases, and materials (e.g., rat traps, lead objects, 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.
- 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.
- 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 at least a 3:1 ratio gear system to initiate the next action.
 - 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.
 - Knock over in series, four free-standing, standard, non-magnetic, commercial dominos with the fourth domino in the sequence initiating the next action.
 - Add 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. Use no more than 9V to power a stationary fan 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 clock 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.
- 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.
 - 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.



MISSION POSSIBLE (CONT.)

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

- 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 receive only participation points for impounding a Device but not competing, unsafe Devices, 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



MOUSETRAP VEHICLE

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

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

A TEAM OF UP TO: 2

IMPOUND: Yes

EYE PROTECTION: B

APPROXIMATE TIME: 8 minutes

2. **EVENT PARAMETERS:**

- Each team must bring and impound one Vehicle, alignment devices (if used), a Practice Log, and additional/spare parts.
- 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 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 4 or more parameters (3 required and at least 1 additional) for 10 or more practice runs. The required parameters are: Target Distance, Vehicle Distance from Target, and Run Time. Each team must choose an additional 4th parameter beyond those required (e.g., # of axle turns for braking, drive arm length, alignment angle) to test.
- Logs must be impounded and will be returned when the team is called to compete.

5. **THE COMPETITION:**

- 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.
- Teams have 8 minutes of Event Time to set up and start up to 2 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, directional control) 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. A Failed Run occurs for any run that does not occur in the 8 minutes, or if the time and/or distance cannot be measured for a Vehicle (e.g., it starts before the Event Supervisor is ready, the participants pick it up before it is measured, it travels in the wrong direction).
 - k. If the Vehicle does not move upon actuation of the trigger, it does not count as a run and the team may set up for another run but will not receive extra Event Time.
 - l. 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. The Event Supervisor is encouraged to use three timers. The middle time of the 3 timers must be the official Run Time. The Run Time must be recorded in seconds to the precision of the timing devices.
 - e. 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. The team with the lowest Final Score in the lowest number Tier wins. Each team's Final Score is their lower Run Score with the lower number Tier.
 - b. The Run Score for each run = 2 pts./cm x Vehicle Distance + 1 pt./sec x Run Time + Penalties.
 - c. 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.
 - d. Run Time starts when the Vehicle begins to move and ends when the Vehicle comes to a complete stop; recoils are considered part of the Run Time. If the Vehicle does not move within 3 seconds after coming to a stop, the run is considered to have ended; the 3 seconds are not included in the Run Time. Any action occurring after that time does not count as part of the run.
 - e. Teams with incomplete Practice Logs will incur a Penalty of 250 points. Teams without impounded Practice Logs will incur a Penalty of 500 points. Practice Log Penalties do not affect Tier placement.



MOUSETRAP VEHICLE (CONT.)

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

- f. Tiers: The highest number Tier will be applied when more than one is applicable:
- i. Tier 1: Runs with no violations
 - ii. Tier 2: Runs with any construction violations
 - iii. Tier 3: Runs with any competition violations
 - iv. Tier 4: Teams with 2 Failed Runs
 - v. Tier 5: Teams that did not impound their Vehicle during the impound period
- g. Tiebreakers in order: 1. Better non-scored Run Score; 2. Faster Run time - scored run; 3. Lower Vehicle Distance - scored run.

SCORING EXAMPLE:

A team's Vehicle stopped 155.3 cm from the Target Point with a Run Time of 5.79 s., without any penalties (Tier 1).

Vehicle Distance	155.3 cm x 2 pts./cm = 310.6 points
Run Time	5.79 s x 1 pt./sec = 5.79 points
+ Penalties	0 pts. = 0 points

Run Score 316.39 points

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.



ORNITHOLOGY

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

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:**

- 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.
- 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.
- In addition to a binder, each team may bring one unmodified and unannotated copy of either the 2020 National Bird List or a 2020 Official State Bird List which does not have to be secured in the binder.

3. **THE COMPETITION:**

- The competition may be run as timed stations and/or as a timed slides/PowerPoint presentation.
- 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.
- Each team will be given an answer sheet on which they will record answers to each question.
- No more than 50% of the competition will require giving common or scientific names.
- 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.
- States may have a modified state or regional list which will be posted on the state website no later than November 1st.
- The National competition will be based on the 2020 National Bird List.
- 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.
- 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 (i.e., rare, common, special concern, endangered).

4. **SAMPLE ACTIVITIES:**

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

5. **SCORING:**

- High score wins.
- 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.



2020 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 [Scientific name is in italics]

ORDER: Anseriformes

Ducks, Geese, and Swans (*Anatidae*)

Black-bellied Whistling-duck

Snow Goose

Canada Goose *Branta canadensis*

Trumpeter Swan [♂]

Wood Duck *Aix sponsa*

Mallard *Anas platyrhynchos* [♂]

Northern Shoveler

Green-winged Teal

Canvasback

Hooded Merganser

ORDER: Galliformes

Partridges, Grouse, Turkeys, and Old World Quail (*Phasianidae*)

*Ring-necked Pheasant

Ruffed Grouse *Bonasa umbellus* [♂]

Wild Turkey *Meleagris gallopavo*

New World Quail (*Odontophoridae*)

Northern Bobwhite [♂]

ORDER: Gaviiformes

Loons (*Gaviidae*)

Red-throated Loon

Common Loon *Gavia immer* [♂]

ORDER: Podicipediformes

Grebes (*Podicipedidae*)

Pied-billed Grebe *Podilymbus podiceps*

Red-necked Grebe

ORDER: Procellariiformes

Albatrosses (*Diomedeidae*)

Laysan Albatross

Shearwaters and Petrels (*Procellariidae*)

Northern Fulmar *Fulmarus glacialis*

ORDER: Pelecaniformes

Pelicans (*Pelecanidae*)

American White Pelican

Pelecanus erythrorhynchos

Bitterns, Herons, and Allies (*Ardeidae*)

American Bittern [♂]

Great Blue Heron *Ardea herodias*

Snowy Egret *Egretta thula*

Green Heron

Black-crowned Night-heron

Ibises and Spoonbills (*Threskiornithidae*)

Roseate Spoonbill *Platalea ajaja*

ORDER: Suliformes

Cormorants (*Phalacrocoracidae*)

Double-crested Cormorant

Phalacrocorax auritus

Darters (*Anhingidae*)

Anhinga *Anhinga 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 *Falco peregrinus*

ORDER: Accipitriformes

Osprey (*Pandionidae*)

Osprey *Pandion haliaetus*

Hawks, Kites, Eagles, and Allies (*Accipitridae*)

Bald Eagle *Haliaeetus leucocephalus* [♂]

Northern Harrier

Cooper's Hawk *Accipiter cooperii*

Red-tailed Hawk *Buteo jamaicensis* [♂]

Golden Eagle

ORDER: Cathartiformes

New World Vultures (*Cathartidae*)

Turkey Vulture *Cathartes aura*

California Condor

ORDER: Gruiformes

Rails, Gallinules, and Coots (*Rallidae*)

Clapper Rail *Rallus longirostris*

Sora [♂]

Purple Gallinule

American Coot

Cranes (*Gruidae*)

Whooping Crane *Grus americana* [♂]

ORDER: Charadriiformes

Lapwings and Plovers (*Charadriidae*)

American Golden-Plover

Killdeer *Charadrius vociferus* [♂]

Oystercatchers (*Haematopodidae*)

American Oystercatcher

Stilts and Avocets (*Recurvirostridae*)

Black-necked Stilt

American Avocet *Recurvirostra americana*

Sandpipers, Phalaropes, and Allies (*Scolopacidae*)

Spotted Sandpiper

Ruddy Turnstone

Dunlin *Calidris alpina*

Wilson's Snipe

American Woodcock *Scolopax minor*

Gulls, Terns, and Skimmers (*Laridae*)

Laughing Gull [♂]

Ring-billed Gull

Herring Gull *Larus argentatus*

Least Tern *Sternula antillarum*

Caspian Tern

Black Tern

Black Skimmer *Rynchops niger*

Auks, Murres, and Puffins (*Alcidae*)

Common Murre *Uria aalge*

Tufted Puffin

ORDER: Columbiformes

Pigeons and Doves (*Columbidae*)

Mourning Dove *Zenaida macroura* [♂]

Common Ground-Dove

*Rock Pigeon *Columba livia*

ORDER: Cuculiformes

Cuckoos, Roadrunners, and Anis (*Cuculidae*)

Black-billed Cuckoo [♂]

Greater Roadrunner

ORDER: Strigiformes

Barn Owls (*Tytonidae*)

Barn Owl *Tyto alba*

Typical Owls (*Strigidae*)

Great Horned Owl *Bubo virginianus* [♂]

Snowy Owl

Barred Owl *Strix varia* [♂]

Screech Owl

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
2019 Cornell University Laboratory of Ornithology.



2020 NATIONAL BIRD LIST

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

ORDER: Caprimulgiformes

Nightjars and Allies (*Caprimulgidae*)

Chuck-will's-widow [♂]

Common Nighthawk

ORDER: Apodiformes

Swifts (*Apodidae*)

Chimney Swift *Chaetura pelagica*

Hummingbirds (*Trochilidae*)

Ruby-throated Hummingbird [♂]

ORDER: Coraciiformes

Kingfishers (*Alcedinidae*)

Belted Kingfisher *Megaceryle alcyon* [♂]

ORDER: Piciformes

Woodpeckers and Allies (*Picidae*)

Red-headed Woodpecker

Yellow-bellied Sapsucker

Downy Woodpecker

Northern Flicker *Colaptes auratus* [♂]

Pileated Woodpecker

ORDER: Passeriformes

Tyrant Flycatchers (*Tyrannidae*)

Olive-sided Flycatcher

Eastern Phoebe *Sayornis phoebe*

Vermilion Flycatcher

Great Crested Flycatcher [♂]

Eastern Kingbird

Scissor-tailed Flycatcher

Shrikes (*Laniidae*)

Loggerhead Shrike

Vireos (*Vireonidae*)

Warbling Vireo

Red-eyed Vireo *Vireo olivaceus*

Jays and Crows (*Corvidae*)

Steller's Jay

Blue Jay *Cyanocitta cristata* [♂]

Black-billed Magpie

American Crow [♂]

Common Raven *Corvus corax*

Larks (*Alaudidae*)

Horned Lark

Swallows (*Hirundinidae*)

Purple Martin

Cliff Swallow

Barn Swallow *Hirundo rustica*

Chickadees and Titmice (*Paridae*)

Black-capped Chickadee [♂]

Tufted Titmouse *Baeolophus bicolor* [♂]

Nuthatches (*Sittidae*)

Red-breasted Nuthatch *Sitta*

canadensis [♂]

White-breasted Nuthatch

Creepers (*Certhiidae*)

Brown Creeper *Certhia americana*

Wrens (*Troglodytidae*)

Cactus Wren

Marsh Wren

Carolina Wren [♂]

Dippers (*Cinclidae*)

American Dipper *Cinclus mexicanus*

Kinglets (*Regulidae*)

Golden-crowned Kinglet

Ruby-crowned Kinglet

Gnatcatchers (*Poliophtilidae*)

Blue-gray Gnatcatcher

Thrushes (*Turdidae*)

Eastern Bluebird

Wood Thrush [♂]

American Robin *Turdus migratorius* [♂]

Mockingbirds and Thrashers

(*Mimidae*)

Gray Catbird

Northern Mockingbird *Mimus*

polyglottos [♂]

Brown Thrasher *Toxostoma rufum*

Waxwings (*Bombycillidae*)

Cedar Waxwing *Bombycilla cedrorum*

Wood-Warblers (*Parulidae*)

Yellow Warbler

Magnolia Warbler *Dendroica magnolia*

Yellow-rumped Warbler

Black-throated Green Warbler

Black-and-white Warbler *Mniotilta*

varia

American Redstart

Ovenbird

Kentucky Warbler

Common Yellowthroat [♂]

New World Sparrow

(*Passerellidae*)

Spotted Towhee *Pipilo maculatus* [♂]

Black-chinned Sparrow

Lark Sparrow

Harris's Sparrow

White-crowned Sparrow

Chipping Sparrow

Dark-eyed Junco *Junco hyemalis*

Longspurs and Buntings (*Calcariidae*)

Lapland Longspur

Snow Bunting

Cardinals and Allies (*Cardinalidae*)

Northern Cardinal *Cardinalis*

cardinalis [♂]

Indigo Bunting

Painted Bunting *Passerina ciris*

Scarlet Tanager

Blackbirds (*Icteridae*)

Bobolink

Red-winged Blackbird [♂]

Western Meadowlark [♂]

Yellow-headed Blackbird

Common Grackle

Brown-headed Cowbird *Molothrus ater*

Baltimore Oriole *Icterus galbula* [♂]

Fringillids and Allies (*Fringillidae*)

Red Crossbill *Loxia curvirostra*

American Goldfinch *Carduelis tristis*

Evening Grosbeak

House Finch

Pine Siskin

Old World Sparrows (*Passeridae*)

*House Sparrow *Passer domesticus*

Old World Starlings (*Sturnidae*)

*European Starling *Sternus vulgaris*

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
2019 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:**

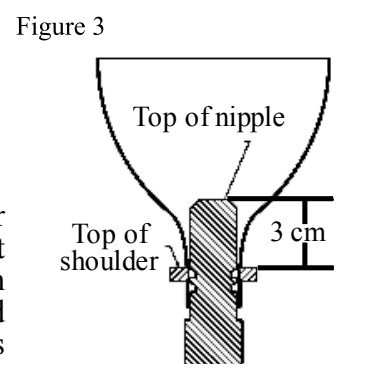
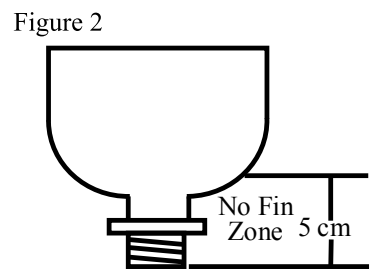
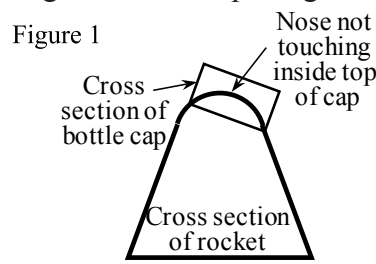
- Teams must provide up to two rockets, two unaltered standard ping pong balls, and two parachutes.
- Parachutes must be attached to ping pong balls with tape only. The ping pong ball attached to the parachute assembly makes up the parachute payload system.
- All participants must properly wear eye protection 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.
- 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 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 Supervisor; 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 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. 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.





PING PONG PARACHUTE (CONT.)

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

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. 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



REACH FOR THE STARS

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

1. **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

2. **EVENT PARAMETERS:**

- a. 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.
- b. Each team may bring two non-programmable, non-graphing calculators as well as two clipboards and two red-filtered flashlights.

3. **THE COMPETITION:**

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

Part I: Written Exam

- a. 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**

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

- a. Participants will be asked to complete one or more hands-on or interpretive tasks selected from the following topics:
 - i. Stellar and galactic evolution
 - ii. Spectral classification of stars
 - iii. Hubble classification of galaxies
 - iv. Observation using multiple portions of the electromagnetic spectrum
 - v. The relationship between stellar temperature, radius, and luminosity
 - vi. Magnitude and luminosity scales, distance modulus, inverse square law

4. **SAMPLE PERFORMANCE TASKS:**

- a. Given the properties and/or spectra of stars and deep sky objects, participants will identify their proper placement on an H-R Diagram.
- b. 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.

5. **SCORING:**

- a. High score wins. Each task and/or question will have been assigned a predetermined number of points.
- b. Ties will be broken by the accuracy and thoroughness of responses.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the *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



ROAD SCHOLAR

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

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:**

- 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.
 - The Event Supervisor will provide all required maps. Participants may NOT write on the maps. Event Supervisors will check the accuracy of reproduced maps or images used by the teams prior to competition and update the answer key if needed.
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. Answer sheets will include areas for the topographic map profile and a one-mile square PLSS section for the student-created map, if those tasks are included on the test. Satellite/aerial photos will be in the visible light spectrum.

Topics/Concepts Assessed

a. Topographic Map

- Marginal information
- Map location/series/scale/index/legend
- Map symbols
- Map features
- Contours
- Elevation of features and symbols
- Survey control marks (control and spot elevations)
- Distance between features (English and metric)
- Azimuths and bearings
- Magnetic declination
- Sector Reference System
- Graticule tick marks /intersections
- Geographic coordinates in degrees, minutes, seconds (Highway maps also)
- Public Land Survey System grids (PLSS)
- Direction of stream flow
- Stream gradients (feet per 1000 ft)
- Slope (feet per 100 feet)
- Universal Transverse Mercator (UTM) coordinates
- Profile drawing

b. Highway Map

Topographic map topics may also be present on highway maps.

- Map legend/tables/index
- Map grid system
- Map features/symbols
- Distances between features
- City/Regional insets
- Geographic coordinates in decimal degrees

c. Student-Created Map

- Map scales
- USGS topographic map symbols and colors
- Distances
- Azimuths and bearings
- Public Land Survey System

d. Satellite Photos/Internet Maps

- Feature identification
- Distances and scales
- Photo time-of-day identification
- Internet map symbols
- Road travel between points

4. **SAMPLE QUESTIONS/TASKS:**

- Use the map index to identify the map coordinates of Cedarville.
- Use the Detroit inset map to compute the distance in miles and tenths along the roads from the Museum of Art to Cobo Arena.
- What do the small triangle and numbers at the intersection of Cross Road and SH 27 indicate?
- Provide the PLSS description of Godwin School to the quarter-quarter section.

5. **SCORING:**

- High score wins. Values of questions may be weighted.
- 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.



WATER QUALITY

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

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:**

- 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.
- 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

- This part will use multiple choice, matching, fill-in-the-blank and/or short answers to assess participants' knowledge in areas such as: 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, watershed resource management issues, sedimentation pollution, harmful species **and recently killed coral**.
- 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

- 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.
- 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):
 - Organisms found around the globe: Banded coral shrimp (*Stenopus hispidus*), Butterfly fish (*Chaetodon spp.*), Crown of thorns starfish (*Acanthaster planci*), Fleishy 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.*)
 - 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
 - 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

- 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.
- No **physical, laboratory** tests will be performed on these topics **by participants**.



WATER QUALITY (CONT.)

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

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.



WRITE IT DO IT

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

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.



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.

Stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators can be used in the following events: Anatomy & Physiology, Astronomy, Chemistry Lab, Circuit Lab, Codebusters, Density Lab, Designer Genes, Disease Detectives, Dynamic Planet, Elastic Launched Glider, Experimental Design (Both Divisions), **Food Science**, Forensics, Geologic Mapping, **Gravity Vehicle**, Heredity, **Machines**, Meteorology, Mousetrap Vehicle, **Reach for the Stars**, Road Scholar, Sounds of Music, Water Quality, and Wright Stuff.



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.

Stand-alone non-programmable, non-graphing calculators, in addition to the above listed calculators, can be used in the following events: Anatomy & Physiology, Astronomy, Chemistry Lab, Circuit Lab, Density Lab, Designer Genes, Disease Detectives, Dynamic Planet, Elastic Launched Glider, Experimental Design (Both Divisions), **Food Science**, Forensics, Geologic Mapping, **Gravity Vehicle**, Heredity, **Machines**, Meteorology, Mousetrap Vehicle, **Reach for the Stars**, Road Scholar, Sounds of Music, Water Quality, and Wright Stuff.



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.

Stand-alone, programmable, graphing calculators and **stand-alone non-graphing, programmable calculators**, in addition to the above listed calculators, can be used in the following events: Astronomy, **Chemistry Lab**, Circuit Lab, Density Lab, Dynamic Planet, Elastic Launched Glider, Experimental Design (Division C), **Gravity Vehicle**, **Machines**, Mousetrap Vehicle, Sounds of Music, and Wright Stuff.



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



Stand-alone non-graphing, programmable calculators are another type of calculator that can be used in the above listed events.

To identify these calculators, 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.

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

PROG Button

EXE Button





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



NATIONAL TOURNAMENT SCHEDULE

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

2020 Division B National Tournament Schedule at North Carolina State University; Raleigh, North Carolina Saturday, May 16, 2020

Event	7:00 - 7:50 AM	8:00 - 9:00 AM	9:15 - 10:15 AM	10:30 - 11:30 AM	11:45 - 12:45 PM	1:00 - 2:00 PM	2:15 - 3:15 PM	7:00 - 9:00 PM		
Anatomy & Physiology		1-10	11-20	21-30	31-40	41-50	51-60			
Booilever		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			
Fossils		11-20	21-30	31-40	41-50	51-60	1-10			
Food Science		21-30	31-40	41-50	51-60	1-10	11-20			
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			

Closing Ceremony





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:

North Carolina State University (2020 National Tournament Host), Cornell University (2019 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, ACE Hardware, Centers for Disease Control and Prevention (CDC), 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, MxD (The Digital Manufacturing Institute), Hardware Science, Japan Science and Technology Agency, Million Women Mentors (MWM) 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

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

