



Exploring the World of Science

Division B Rules Manual

Division B (Gr. 6-9)

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Welcome to the 2013 Science Olympiad! This Rules Manual will help you prepare to compete in one of the more than 350 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.

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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/scenarios 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).

Science Olympiad Team Membership

Science Olympiad requires that all secondary 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, Junior Varsity, 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 Policy section of the national website: General Rules & Code of Ethics, Scoring Guidelines, Home & Virtual Schools, Small Schools, All Stars, Copyrights and Use, Lasers, Building Policy, Eye Protection and Wristband Procedures.

CHECK OUT THE SCIENCE OLYMPIAD WEB STORE FOR ALL YOUR SCIENCE OLYMPIAD NEEDS!

Please visit www.store.soinc.org to purchase manuals, DVDs, teaching materials, and CDs for Division B, Division C and Elementary Science Olympiad. You'll find new 2013 products, multiple shipping and payment options and a handy email confirmation system.

Science Olympiad Store: 866-312-3999



SCIENCE OLYMPIAD DIVISION B RULES MANUAL

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- Please read the **General Rules** on the back inside cover - they apply to all events. Note: all changes are in **bold**.
- Coaches: Please remember to register early for the Science Olympiad Summer Institute – sold out last year!
- Please visit the Science Olympiad web site: <http://www.soinc.org> for News, Clarifications, FAQs, Membership Information, Team Size Requirements, New Store Items and other valuable information, tips and resources.

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1. **DESCRIPTION:** This event encompasses the anatomy (structure and function) of the digestive and nervous systems.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 Minutes

2. **EVENT PARAMETERS:** Each team may bring **only** one 8.5" x 11" two-sided page of information in any form from any source and up to 2 non-programmable, non-graphing calculators.

3. **THE COMPETITION:** Students should know the basic anatomy of the digestive and nervous systems and how aging and specific diseases affect them. Process skills expected may include data collection, making observations, inferences, predictions, calculations, analyses and conclusions. The test may include various formats (e.g., timed stations, written test, slides, etc.) **limited** to the following topics:

a. **DIGESTIVE SYSTEM - All levels should know:**

- i. Functions of the digestive system
- ii. Basic anatomy of the component parts of the alimentary canal and accessory organs of digestion
- iii. Anatomy of the four layers of the wall of the alimentary canal
- iv. Comparison of the lining of the esophagus, stomach, small intestine and large intestine
- v. Compare and contrast mechanical and chemical digestion
- vi. The effects of exercise on the digestive system
- vii. The diseases on each level from the cell to the whole person as listed: stomach & duodenal ulcers, cancers of the digestive system, diarrhea, lactose intolerance, hepatitis, appendicitis
- viii. Treatment and prevention of all described diseases



National Level Only:

- ix. Specific functions of the liver and pancreas in the digestive system
- x. Additional diseases: Crohn's disease, GERD, diverticular disease

b. **NERVOUS SYSTEM - All levels should know:**

- i. The Brain - major regions of the brain and their functions
- ii. Sense Organs - regions of the sense organs and their functions
- iii. Disorders: Epilepsy, seizures, Alzheimer's Disease, Multiple Sclerosis and Parkinson's Disease, shingles (herpes zoster), cerebral palsy, glaucoma, pink eye (conjunctivitis)
- iv. Effects of drugs: alcohol, caffeine, nicotine, and marijuana on the nervous system



National Level Only:

- v. Central Nervous System - organization of the spinal cord
- vi. Neural Impulses - Cellular anatomy and types of neurons
- vii. Neural circuitry connecting the eye to the brain, tracing light detection from eye to brain
- viii. Treatment and prevention of described diseases and drugs

4. **SCORING:** High score wins. Selected questions/quality of free-response answers will be used to break ties.

Recommended Resources: All reference and training resources including the in-depth **Anatomy and Physiology CD (APCD)** and the introductory **Bio/Earth CD (BECD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

THIS EVENT IS SPONSORED BY THE SOCIETY FOR NEUROSCIENCE (www.sfn.org)



BOOMILEVER

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

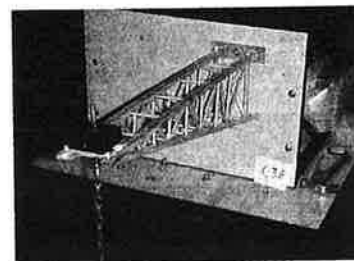
1. **DESCRIPTION:** The objective of this event is to design and build the most efficient Boomilever meeting the requirements specified in these rules. A Boomilever is a cantilevered wood and glue structure, mounted to a vertical Testing Wall, carrying a load at a distance from the Wall.
A TEAM OF UP TO: 2 IMPOUND: NO EYE PROTECTION: #2 MAXIMUM TIME: 10 min
2. **EVENT PARAMETERS:**
 - a. Each team is allowed to enter only one Boomilever, built prior to the competition.
 - b. Team members must wear proper eye protection during the set-up and testing of the Boomilever. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Teams without eye protection must not test and will be ranked in Tier 4.
 - c. The Event Supervisor must provide all assessment devices, testing apparatus, hardware, and clean, dry sand or similar dry, free-flowing material (hereafter "sand").
3. **CONSTRUCTION PARAMETERS:**
 - a. The Boomilever must be a single structure designed to attach to one or more mounting hole(s) in the Testing Wall (4.b.), support a Loading Block (4.a.), and test a load up to 15.0 kg at a distance from the Wall.
 - b. The Boomilever must not contact the Testing Wall at any time more than 20.0 cm (Div. B) or 15.0 cm (Div. C) below the centerline of the mounting holes.
 - c. The center of the Loading Block, measured horizontally from the face of the Testing Wall, must be between 40.0 cm and 45.0 cm.
 - d. The Loading Block must be initially supported no more than 25 cm below the center of the mounting holes.
 - e. The Boomilever must have an Attachment Base for attaching it to the Testing Wall as follows:
 - i. The Attachment Base may be one or more parts, made from any type or size of wood or wood products (e.g., particleboard, wood composites, commercial plywood, sawdust, and glue, etc.). As long as it does not violate rule 3.b., it may be any size that can be accommodated by the Testing Wall.
 - ii. Mounting holes in the Attachment Base must align with the holes in the Testing Wall.
 - iii. When ready to test, any portion of the Attachment Base extending more than 1.3 cm ($\frac{1}{2}$ ") from the face of the Testing Wall must meet the material requirements listed below for the Boomilever.
 - iv. The Attachment Base must be a permanent part of the Boomilever, and is included in its mass.
 - f. There is no limit to the height of the Boomilever or Loading Block above the Testing Wall.
 - g. The Boomilever must not be attached or hooked to any edge of the Testing Wall. All tensile and shear connection to the Testing Wall must be through the mounting bolts.
 - h. All parts of the Boomilever more than 1.3 cm ($\frac{1}{2}$ ") from the face of the Testing Wall must be constructed of wood and bonded by glue. No other materials are permitted (e.g., bamboo, grasses, or paper).
 - i. There are no limits on the cross section sizes or lengths of individual pieces of wood. Wood may be laminated by the team without restriction.
 - j. Any commercially available bonding material (glue) may be used. Adhesive putty is not permitted.
4. **TESTING APPARATUS:**
 - a. The Loading Block must be a square block measuring 5.0 cm x 5.0 cm x approximately 2.0 cm with a hole in the center of the square faces for a $\frac{1}{4}$ " threaded eyebolt.
 - b. The Testing Wall must be a vertical, solid, rigid surface as follows:
 - i. The Testing Wall must be at least 40.0 cm wide x 30.0 cm high, minimum $\frac{3}{4}$ " high grade plywood or other suitable material, with a smooth, hard, low-friction surface, and must not bend noticeably when loaded.
 - ii. The Testing Wall must have three mounting holes for $\frac{1}{4}$ " bolts, horizontally aligned, and centered approximately 5.0 cm below the top of the Testing Wall. The middle hole must be centered on the face of the Testing Wall and the center of the other holes placed 10.0 cm from the center of the middle hole. The centerlines of the holes must be visible on the face of the Testing Wall.
 - iii. Three sets of $\frac{1}{4}$ " x 3" minimum length bolts with $\frac{3}{4}$ " O.D. flat washers and wing nuts must be provided to attach the Boomilever to the Testing Wall.
 - iv. The Contact Depth Line is a horizontal line that must be clearly visible below the centerline of the mounting holes at 20.0 cm (Div. B) or 15.0 cm (Div. C).
 - c. A $\frac{1}{4}$ " threaded eyebolt, chain and hook must be suspended from the Loading Block.
 - d. An approximately five gallon plastic bucket with a handle must be suspended from the chain or hook with enough clearance above the floor to allow for Boomilever deflection.

BOOMILEVER (CONT.)

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- e. The Event Supervisor must verify that the combined mass of the Loading Block, chain, bucket, sand, and attaching hardware is at least 15.000 kg and no more than 15.300 kg prior to testing.
 - f. At the Event supervisor's discretion, more than one testing apparatus may be used to ensure all teams can compete in a timely manner.
- 5. COMPETITION:**
- a. No alterations, substitutions, or repairs may be made to the Boomilever after check-in for competition. Once teams enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished.
 - b. All Boomilevers must be assessed prior to testing for compliance with construction parameters.
 - c. Team members must place their Boomilever on the scale for the Event Supervisor to determine its mass in grams to the nearest 0.01 g.
 - d. Team members must have a maximum of ten minutes to set up and test their Boomilever either to the maximum load or failure.
 - e. Team members must attach their Boomilever to the Testing Wall using any one or more of the mounting holes and may insert the bolts from either side of the wall. Teams must assemble the Loading Block, eyebolt, chain and hook, and hang the bucket as required to load the Boomilever. Team members may disassemble the block and eyebolt if necessary to set up the test.
 - f. Teams must adjust the Loading Block to be within the permitted distance from the Testing Wall.
 - g. Prior to the placement of the Loading Block and bucket assembly the Event Supervisor must measure the Boomilever's Clearance from the Contact Depth Line to the nearest 0.1 cm. Time used by the Event Supervisor for this measurement must not count toward the 10 minute event time.
 - h. Team members must be allowed to adjust the Boomilever until they start loading sand. No adjustment may be made after loading of sand has begun.
 - i. Team members must be allowed to safely and effectively stabilize the bucket from movement caused by loading of the sand.
 - j. Boomilevers that fail before supporting 15.000 kg must be scored according to the actual load supported at time of failure, measured to the nearest gram or best precision available. Failure is defined as the inability of the Boomilever to carry any additional load or any part of the load is supported by anything other than the Boomilever. Loading must stop immediately when a failure occurs or when time expires. The Event Supervisor must remove any sand and wood fragments added after failure.
 - k. If a Boomilever is removed after testing there can be no further challenges for scoring or ranking.
- 6. SCORING:**
- a. The Load Scored will be the load supported or 15.000 kg if the load supported is greater than 15.000 kg. This includes the mass of all the testing apparatus supported by the Boomilever. The least possible load scored must be the mass of the Loading Block. Boomilevers that cannot support the Loading Block will be ranked in Tier 4.
 - b. Boomilevers must be scored and ranked in the first 3 tiers by the highest Efficiency Score:

$$\text{Efficiency Score} = \text{Load Scored (g)} / \text{Mass of Boomilever (g)}$$
 - c. Boomilevers will be scored in four tiers as follows:
 - i. Tier 1: Boomilevers meeting all the Construction Parameters and no Competition Violations.
 - ii. Tier 2: Boomilevers with one or more Competition Violations.
 - iii. Tier 3: Boomilevers with Construction Violations or both Competition and Construction Violations.
 - iv. Tier 4: Boomilevers unable to be loaded for any reason (e.g., cannot be mounted on testing Wall, cannot accommodate loading block, or failure to wear eye protection) will only receive participation points.
 - d. Ties are broken by this sequence: 1. Greatest Clearance from Contact Depth Line; 2. Lowest Boomilever Mass.



SCORING EXAMPLES:

Mass = 14.27 g, load scored = 13,235 g, score = 927.47

Mass = 16.92 g, load scored = 15,000 g, score = 886.52

Mass = 10.30 g, load scored = 15,000 g, contact depth = 20.4 cm; score = 1456.31 (Tier 3)

Recommended Resources: All reference and training resources including the **Boomilever DVD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

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: #4** **APPROXIMATE TIME: 50 minutes**

2. **EVENT PARAMETERS:** Students may bring only specified items. No other items including calculators are allowed. The event supervisors will check the kits, confiscate non-allowed items, and have the right to penalize a team up to 10% if additional items are in the kit.

a. **Students may bring** only these items:

- i. test tubes & racks, spot plates, well plates, reaction plates or similar small containers for mixing
- ii. something for scooping & stirring
- iii. pH paper
- iv. magnet(s)
- v. hand lens(es)
- vi. microscope slides and cover slips

- vii. forceps or tweezers
- viii. writing instruments
- ix. paper towels
- x. **one 8.5" x 11" two-sided page of notes per team** containing information in any form from any source

Note: Students not bringing these items will be at a disadvantage. The event supervisor will not provide them.

b. **Supervisor will provide:**

- i. Iodine reagent (KI solution)
- ii. 1M HCl
- iii. chromatography materials plus containers
- iv. waste container(s)
- v. wash bottle with distilled water (no more than 250 mL)

The supervisor may provide:

- vi. other equipment (e.g., microscope, probes, calculator, etc.), or
- vii. candle & matches if fibers given, or
- viii. differential density solutions or other method of determining density of polymers if plastics given or
- ix. reagents to perform additional tests.

- c. **Safety Requirements:** Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see <http://soinc.org>), pants or skirts that cover the legs to the ankles, and additionally a long sleeved lab coat that reaches the wrists and the knees or a long sleeved shirt that reaches the wrists with a chemical apron that reaches the knees. Chemical gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event.



3. **THE COMPETITION:** All competitions will consist of evidence from Parts 3.a., 3.b., 3.c., 3.d., and 3.e. (Analysis). The amount of evidence included will be according to the following table:

Level	Part 3a (i-iii)	Limit on Mixtures from Part 3.a.i. only	Part b	Part c	Part d	Part e
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

Questions can only be asked on the evidence topics included in the competition.

a. **Qualitative Analysis:** The unknown common materials will be taken from the following lists.

- i. 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).

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- ii. **Non-Powdered Metals:** aluminum, iron, zinc, magnesium, copper, and tin.
 - iii. **Liquids:** lemon juice, rubbing alcohol (isopropyl), household ammonia (3%), water, vinegar, hydrogen peroxide (3%). Every team gets the same set of unknowns (evidence). The unknowns will be identifiable by performing tests such as solubility, acidity, magnetic property, color, density, and odor. The scenario will identify which containers may hold the mixtures.
- b. **Polymer Testing/Natural and Man-made Substances:** Students will demonstrate their skill in identifying and collecting evidence from a variety of sources such as:
- i. Hair (the difference between human, dog, cat, not specific kinds of hair),
 - ii. Fibers (the difference between animal, vegetable, synthetic, not specific kinds of fibers), and
 - iii. Recyclable plastics (PETE, HDPE, non-expanded PS, LDPE, PP, PVC). No burn test allowed but burn results may be provided.
- c. **Paper Chromatography:** Students 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.
- d. **Crime Scene Physical Evidence:** Students will also demonstrate their skill in collecting and/or analyzing evidence from a variety of other sources such as:
- i. **Fingerprints:** Students may be asked to identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
 - ii. **DNA evidence:** Students may be asked to compare DNA chromatograms/electropherograms from materials found at the scene to those of the suspects.
 - iii. **Shoepprints & tire treads:** Students may be asked to compare prints and make conclusions such as direction and speed of travel. No calculations are expected to be performed.
 - iv. **Soil:** Students 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.
 - v. **Spatters:** Analyze spatter patterns for speed and direction of impact. No calculations are expected to be performed.
- e. **Analysis:** In addition to identifying each piece of evidence and answering basic questions within each topic, students will be expected to draw logical conclusions about the event as a whole. Question may include but are not limited to who is/are the prime suspect(s), who is/are not suspect(s), and sequencing of events. It is expected that conclusions made will be supported by reference to specific evidence and/or testing.
- f. The collected evidence and other data given may be used in a mock crime scene.
4. **SCORING:**
- a. 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.a.=50%, 3.b.=10%, 3.c.=5%, 3.d.=10%, and 3.e.=25%. Actual point values will be shown at each question.
 - b. First tiebreaker is Part 3.e. Second tiebreaker is Part 3.a. Third tiebreaker is Part 3.b.
 - c. Waste will be disposed of as directed by the event supervisor. A penalty of up to 10% may be given if the area is not cleaned up as instructed by the event supervisor.



Recommended Resources: All reference and training resources including the **Science Crime Busters Manual and the Science Crime Busters CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will use their investigative skills in the scientific study of disease, injury, health, and disability in populations or groups of people with a focus on **Environmental Quality**.
A TEAM OF UP TO: 2 **APPROXIMATE TIME:** 50 minutes
2. **EVENT PARAMETERS:** Each team may bring **only** one 8.5" x 11" two-sided page of information in any form from any source and up to 2 non-programmable, non-graphing calculators.
3. **THE COMPETITION: Sample Problems and Resources** may be found at <http://www.soinc.org>
 - a. This event combines a basic understanding of biological and physical agents that cause disease with an ability to analyze, interpret, evaluate and draw conclusions from simple data and communicate results to peers. Students should be able to distinguish between infectious and non-infectious health burdens.
 - b. A broad definition of health will be used for this event. Potential topics include health as well as illness (mental, physical, infectious, chronic, environmental, societal, genetic, injuries and health behaviors).
 - c. This event will include questions based on:
 - i. **Study design and data collection.**
 - ii. Creating graphic displays of data.
 - iii. Interpreting trends and patterns of epidemiologic data.
 - iv. **C Division only: Recognizing and accounting for potential sources of error (e.g., random, systematic, confounding and various types of bias).**
 - v. Communicating results.
 - d. Students will be presented with one or more descriptions of public health problems such as an outbreak of food poisoning, a cluster of cases of West Nile encephalitis or state data on bicycle injuries.
 - e. Based on these descriptions, they will be expected to do the following:
 - i. Generate hypotheses and recognize various fundamental study designs.
 - ii. Evaluate the data by calculating and comparing simple rates and proportions.
 - iii. Identify patterns, trends and possible modes of transmission, sources or risk factors.
 - iv. Recognize factors such as study design/biases that influence results (more for Div. C-less for Div. B).
 - v. Propose interventions based on promoting positive health behaviors, eliminating or reducing risks of environmental exposures, or disrupting clearly identifiable chains of transmission.
 - vi. Translate results/findings into a public health/prevention message for identified populations at risk.
 - f. They will also be expected to:
 - i. Define basic epidemiological and public health terms (e.g., outbreak, epidemic, pandemic, surveillance, risk, vector, fomite, zoonosis, etc.).
 - ii. Recognize various categories of disease causing agents & give examples of illnesses caused by each.
 - iii. Recognize and understand differences between the major groups of infectious agents (e.g., viruses, bacteria, protists, fungi and animals).
 - iv. Recognize examples of various epidemiologic and public health phenomena such as types of outbreaks and modes of transmission.
 - g. Calculations and mathematical manipulations should be part of the competition. Data may be contrived or modified to make it more appropriate for this age group as long as it does not radically alter results or interpretation.
 - h. Process skills may include hypothesis, observations, inferences, predictions, variable analysis, data analysis, calculations, and conclusions.
 - i. The level of questioning for B/C competitions should reflect the age-appropriateness for the two groups.
 - j. The event format may be exam-based, station-based or a combination of both.
4. **SCORING:**
 - a. Points will be assigned to the various questions and problems. Both the nature of the questions and scoring rubric should emphasize an understanding that is broad and basic rather than detailed and advanced.
 - b. 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.
 - c. Points should be awarded for both quality and accuracy of answers, the quality of supporting reasoning, and the use of proper scientific methods.
 - d. Highest number of points will determine the winner. Selected questions may be used as tiebreakers.



Recommended Resources: All reference and training resources including the **Bio/Earth CD** and the in-depth **Disease Detectives CD** are available on the Official Science Olympiad Store or Website at www.soinc.org

THIS EVENT IS SPONSORED BY: The U.S. Centers For Disease Control And Prevention



DYNAMIC PLANET

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will use process skills to complete tasks related to **glaciation and long-term climate change**.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:** Each team may bring four 8.5" x 11" double-sided pages of notes containing information in any form from any source and bring up to two non-graphing calculators.

3. **THE COMPETITION:** Participants will be presented with one or more tasks, many requiring the use of process skills (e.g., observing, classifying, measuring, inferring, predicting, communicating, and using number relationships) from the following topics:

- a. Glacial formation, mass-balance, and flow
- b. Glacier and ice sheet types and forms (alpine and continental)
- c. Glacial erosion, erosional landforms, and sediment transport
- d. Glacial depositional landforms and sediments
- e. Interpretation of glaciers and glacially altered landscape features shown on USGS topographic maps
- f. Periglacial environment processes and landforms
- g. Glaciers in the hydrologic cycle: impacts on climate, streams, lakes, and oceans, sub-glacial hydrology, isostatic effects on Earth's crust
- h. Pleistocene and pre-Pleistocene glacial history: evidence and chronology
- i. Theories explaining glacial and ice sheet advance and retreat (e.g., Milankovich cycles)
- j. Glaciers as indicators of modern global climate change



4. **REPRESENTATIVE TASKS:**

- a. Analyze and interpret features and actions of a mountain glacier appearing on a topographic map including elevation, gradient, ablation and accumulation zones, direction of flow, medial moraines, crevasses, valley shapes, erosional landscapes, and depositional features
- b. Analyze a geologic map of glacial deposits to determine the sequence of events over the course of several episodes of advance and melt-back
- c. Interpret oxygen isotope data from a sediment core to identify changes in sea level caused by glacial advance and melting

5. **SCORING:** High score wins. Points will be awarded for the quality and accuracy of responses. Ties will be broken by the accuracy and/or quality of answers to pre-selected questions.

Recommended Resources: All reference and training resources including the **Bio/Earth CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>.

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** This event will determine a team's ability to design, conduct, and report the findings of an experiment actually conducted on site.
A TEAM OF UP TO: 3 **EYE PROTECTION:** #4 **APPROXIMATE TIME:** 50 minutes
2. **EVENT PARAMETERS:** Students must bring ANSI Z87 indirect vent chemical splash goggles and a writing instrument(s). Students may also bring a timepiece, a ruler, and a non-programmable calculator. Chemicals that require other safety clothing will not be used.
3. **THE COMPETITION:**
 - a. Supervisors must provide teams with identical sets of materials at a distribution center or in a container. 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 is to remain unknown until the start of this event and will be the same for each team. The students must use at least two of the provided materials to design and conduct an experiment.
 - b. The supervisor must assign a question/topic area that determines the nature of the experiment. The assigned question/topic area should be the same for all teams and allow students to conduct experiments involving relationships between independent and dependent variables (like height vs. distance).
 - c. The students will be given an outline (patterned after the scoring rubric) to follow when recording/reporting their experiment with additional paper to record data, graphs and procedures.
 - d. When the teams are finished, all materials must be returned to the event supervisor along with all written materials. The content of the report must be clearly stated and legible.
4. **SCORING:** Scoring of the event will be done using the scoring rubric at the bottom of this page. Zero points will be given for an inappropriate or no response. Points will be awarded dependent upon the completeness of the response. Ties will be broken by comparing the point totals in the scoring areas in the following order: Total points for 1-Variables, 2-Procedure, 3-Analysis of Results, 4-Graph, 5-Data Table. Any team not following proper safety procedures will be asked to leave the room and will be disqualified from the event. Any student not addressing the assigned question or topic area will be ranked behind those who do, because not conducting an experiment is a violation of the spirit of the event.

EXPERIMENTAL DESIGN RUBRIC/REPORTING FORM

- a. Statement of Problem: Experimental Question (2 Points)
- b. Hypothesis: Including prior knowledge that contributed to hypothesis (4 Points)
- c. Variables:
 - i. Constants: (Controlled Variables) Factors that are purposefully kept the same (4 Points)
 - ii. Independent Variable: Factor being manipulated (3 Points)
 - iii. Dependent Variable: Factor being measured which responds (3 Points)
- d. Experimental Control (**where applicable**): (Standard of Comparison) (2 Points)
- e. Materials (3 Points)
- f. Procedure: Including Diagrams (6 Points)
- g. Qualitative Observations During Experiment & Summary of Results: (4 Points)
- h. Data Table: Including Use of Significant Figures for Division C (6 Points)
 - i. Graph(s): (6 Points)
 - j. Statistics: **Div. B:** Average (mean), median, mode, range, or drawn in line of best-fit (2 Points)
Div. C all of B: + standard deviation and any other relevant statistics that teams choose (4 Points)
 - k. Analysis of Results: Interpretation (4 Points)
 - l. Possible Experimental Errors including identified human errors (3 Points)
- m. Conclusion: Include why your results did or did not support the hypothesis: (4 Points)
- n. Recommendations for Further Experimentation Based on Your Data & Practical Applications: (4 Points)



Hints: a. Statement of problem should not have a yes or no answer. It should be specific to the experiment being conducted and is not the same as the assigned topic area. b. Experiments should consist of repeated trials. c. Variables should be operationally defined. d. Experiments should be simple and have only one independent and one dependent variable.

Recommended Resources: All reference and training resources including the **Experimental Design Guide or CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Using their understanding of the chemistry and physical properties of baking ingredients, teams will answer questions at a series of stations.

A TEAM OF UP TO: 2

EYE PROTECTION: #4

APPROXIMATE TIME: 50 minutes

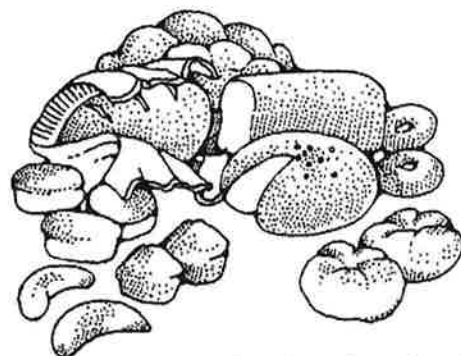
2. **EVENT PARAMETERS:**

- Prior to the event, teams must make and bring a viscosity-testing device (only one is needed but back-ups are permitted) and prepare standard curve graph(s) using their homemade viscosity-testing device. **Teams may bring their entire device including a timer and a stand to use with their viscosity-testing device.**
- Teams must bring something to write with and may bring: calculators and one 3-ring binder, any size, containing information in any form from any source including results and analysis of their prior experimentation (i.e., teams are encouraged to bake goods, observe and record the differences caused by adjusting the ingredients from the Approved List of Ingredients).
- Event Supervisors must provide: Ingredients to be tested from the Approved List of Ingredients, reagents, and lab equipment for all labs and activities.
- Safety Requirements: Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see <http://soinc.org>), pants or skirts that cover the legs to the ankles, and additionally a long sleeved lab coat that reaches the wrists and the knees or a long sleeved shirt that reaches the wrists with a chemical apron that reaches the knees. Chemical gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event.

3. **THE COMPETITION:**

- a. All ingredients in the activities or lab stations are limited to the following Approved List of Ingredients:

- Liquids: water, milk (whole/reduced, cow, goat, almond, buttermilk, soy, coconut), eggs, and egg substitute
- Lipids: vegetable oil, shortening, butter, margarines, chocolate
- Leavening Agents: baking powder, baking soda, yeast, cream of tartar
- Flavoring: Salt and vanilla (essential oils and extracts- Nationals only)
- Flours: all-purpose white, cake, whole wheat, almond, coconut, corn, rice
- Sweeteners: sugar, brown sugar, honey, molasses, sucralose, aspartame, fructose



- There must be one activity/lab station and related questions where teams will determine the viscosity, in centipoises (cP), of any one individual ingredient (Regional & State) or one combination of ingredients (Nationals) from the Approved List of Ingredients using their homemade viscosity-testing device and standard curve graph.
- There must be at least seven other activities/lab stations with questions related to the Approved List of Ingredients or baked goods made from those ingredients. The activities or stations must be related to this list of topics or tasks:

- | | | |
|--------------------|----------------------|---|
| i. Lipids | v. Liquids | ix. Nutritional value of a sample label |
| ii. Proteins | vi. Leavening agents | x. Other measurable properties of baked goods |
| iii. Carbohydrates | vii. Sweeteners | |
| iv. Starches | viii. Density | |



FOOD SCIENCE (CONT.)

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

4. SCORING:

- The team with the highest score wins.
- Time will not be used for scoring.
- Ties are broken by the accuracy of the viscosity testing device activity/station. If teams do not bring a viscosity-testing device, ties are broken by an essay question designated by the event supervisor. **Teams will turn in a copy of their standard curve with the results of their viscosity experiment clearly marked.**
- Penalties: A penalty of up to 10% if the team's area is not cleaned up as instructed by the event supervisor. Teams without a homemade viscosity-testing device receive zero points for the viscosity testing activity/station.

5. Sample Activities, Lab Stations, and Relevant Questions:

- Teams may answer questions concerning chemical properties of approved ingredients and their use in baking (e.g., understanding of chemical test reactions using Benedict's, Biuret, Iodine, brown bags, etc.).
- Teams may answer questions about how different ingredients and different amounts of ingredients used during the baking process affect the final product. For example, what is the difference in using corn oil or butter and how does this affect the final product?
- Teams may answer questions about how baking powder differs from baking soda or yeast as leavening agents (e.g., explain the affect altitude has on baking and what adjustments are necessary in baking procedures due to altitude.).
- When given data, teams may calculate the nutritional value of a sample and answer questions concerning computation of nutrition and energy stored in foods.
- Teams may be required to measure the density of a baked good.
- When given only a recipe from the Approved List of Ingredients, teams may be required to produce a list of ingredients (found on a sample nutritional label) in order by the greatest mass.
- Given only a recipe, students may be required to identify which ingredients are the sources of starch, protein, etc.
- Given information about taste and texture of a baked good, teams may identify possible mistakes or substitutions made in a recipe. For instance if told a baked good is dry and crumbly but has no over cooked starch, students could identify the problem as the ingredients were not mixed properly or insufficient liquid was put into the batter, but not a result of baking too long. Students will use the results of their testing to answer these questions.

Homemade Viscosity Testing Device: Viscotesters can be made by drilling a 7/64" hole from the inside out of a 30 ml scoop or cup for liquids less than 200 cP viscosity, and a 5/32" hole for liquids with viscosities greater than 200 cP. Volumes of liquids provided at the event will be between 30-50 ml/team. When using the viscotester, materials should be filled above a start line, the flow started, and timed from the time the surface reaches the start line and a stop line which should be between 1-2 cm. Record your data to create your standard curve graph(s).

Standard Curve Graph: Create a graph of time to break flow vs. viscosity in *centipoise* (cP) using the homemade viscosity-testing device and **some of** the following liquids at 20°C:

i. Water	1 cP	vii. Carnation Evaporated Sweetened Milk	1200 cP
ii. Milk	5 cP	viii. Hershey's Chocolate Syrup	1500 cP
iii. Crisco® Canola Oil	40 cP	ix. Brer Rabbit Light Molasses	3000 cP
iv. Virgin Olive Oil	50 cP	x. Meadow Gold or Eagle Brand Evaporated Sweetened Milk	5000 cP
v. Great Egg Spectations	200 cP	xi. Pure Honey	7000 cP
vi. Castor Oil	900 cP		

Recommended Resources: All reference and training resources including the Chem/Phy Sci CD are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

1. **DESCRIPTION:** This event will test student knowledge of North American trees that are on the Official National Tree List.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

Each team may bring **two** 8.5" x 11" two-sided pages of information in any form from any source (e.g., **notes, tree lists, etc.**) and up to two commercially published **resources** that may be annotated and tabbed (limit 3 words).



3. **THE COMPETITION:**

- a. For the **National** Competition, all questions will be restricted to specimens on the **Official Science Olympiad National Tree List**. For **Regional and State Competitions**, the **State Director** may reduce the national list to local or regional trees and add a few local species not on the National List. This State List should be sent to competing teams as soon as possible so teams may gather specimens.
 - b. This event may be held either indoors or in a wood lot or both. Specimens (or pictures/slides if necessary) will be lettered or numbered at stations. Each team will be given one answer sheet to record the Genus and species name and the answers to the correlated questions.
 - c. **Leaf specimens used for identification (compound leaves should be intact) may be live, preserved, or color photographs depending on availability and may be accompanied by twigs, cones, seeds, or other parts of the tree.** For each specimen, students will be asked a correlated question that pertains to the tree's structure, ecology, or economic characteristics. Structural characteristics may include leaf types, leaf shapes, leaf margins, leaf venation, leaf arrangement on the stem, twigs, bark, flowers, cones, fruits, seeds, and tree shapes.
 - d. Ecological characteristics may include habitats, adaptations to the environment, biomes, succession, and relationships (e.g., symbiosis and competition) with animals or other plants. Economic characteristics may include beneficial or detrimental aspects of trees such as sources of food, medicine, building materials, chemicals, fuel, fiber, and trees as nuisance species.
4. **SCORING:** The teams with the highest number of correct answers will be the winners. Selected questions may be used as tiebreakers.

Recommended Resources: All specimens listed on the **Official Science Olympiad National Tree List** are represented in the **National Audubon Society Field Guide(s) to Trees** (Eastern and Western regions), which are available on the Official Science Olympiad Store or Website at <http://www.soinc.org> as are all reference and training resources.

1. **DESCRIPTION:** Teams construct and test free flight rubber-powered helicopters prior to the tournament to achieve maximum flight times.

A TEAM OF UP TO: 2

IMPOUND: None

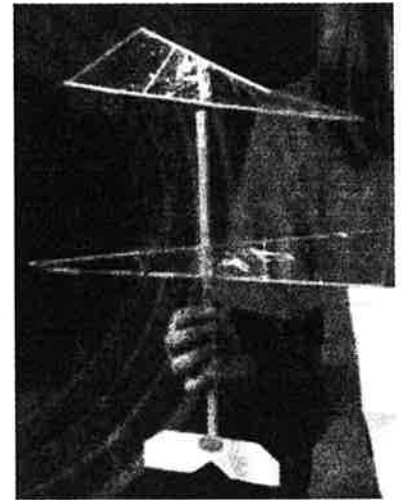
TIME: approximately 15 minutes

2. **EVENT PARAMETERS:**

- Teams must bring up to 2 helicopters. Teams may bring any tools and their flight log.
- Event Supervisor provides all measurement tools and timers.

3. **CONSTRUCTION PARAMETERS:**

- DESIGN:** Helicopters may be constructed from published plan(s), commercial kits and/or a student's design. Kits must not contain any pre-glued joints or pre-covered surfaces. A flat balsa wood disc, large enough to cover a dime, must be the upper most part of the helicopter (the part that would touch a flat ceiling first during a flight) - rule 4.j. applies to the balsa disc.
- MATERIALS:** Boron filaments must not be used anywhere on the helicopter. Any other material may be used anywhere on the helicopter.
- MASS:** Total mass of the helicopter throughout the flight, excluding the rubber motor, **must be 3.0 grams or more.**
- ROTORS:** Rotors are defined as surfaces that contribute lift by rotating on a common path around a vertical axis. The helicopter may use up to three fixed pitch rotors, not exceeding a **maximum diameter of 30.0 cm.** There is no maximum limit on the number of blades or their chord. There must not be any other lifting surfaces.
- ROTOR CONSTRUCTION:** Competitors must construct the rotors themselves. Commercially available rotors or propellers must not be used in whole or part. Rotor thrust bearings may be commercially available items.
- POWER:** The helicopter must be powered by rubber motor(s) of any mass. Motor(s) must be removable from the helicopter for check-in. Motors may be lubricated before and/or after check-in. Officials need not mass the motors.
- MARKING:** Each helicopter must be labeled so the Event Supervisor can easily identify to which team it belongs.



4. **THE COMPETITION:**

- The event must be held indoors. Tournament officials must announce the room dimensions (approximate length, width and ceiling height) in advance of the competition. Tournament officials are urged to minimize the effects of environmental factors such as air currents (e.g., doors, fans). Rooms with minimal ceiling obstructions are preferred over very high ceilings.
- Once competitors enter the cordoned off competition area to trim, practice or compete, they must not receive outside assistance, materials or communication. Teams violating this rule will be ranked below all other teams. There must be a separate area designated for spectators.
- Each team must present a flight log of recorded data during inspection. Data must include at least 6 parameters for at least 10 test flights prior to the competition. The required parameters are: 1) motor size before windup, 2) number of turns on the motor at launch, 3) flight time. The team must choose 3 additional data parameters beyond those required (e.g. turns remaining after landing, estimated/recorded peak flight height, the motor torque at launch).
- At the Event Supervisor's discretion, practice flights may occur throughout the event but must yield to any official flight. Multiple practice flights may occur at the same time. No trim (practice) flights will be permitted in the last half-hour of the event, except for teams that declare a trim flight during their 8-minute flight period.

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- e. A self-check inspection station may be made available to competitors for checking their helicopters prior to being checked by the Event Supervisor.
 - f. Competitors may use any type of winder, but electricity may not be available.
 - g. Competitors must present their event materials (helicopter(s), motor(s), and log) for inspection immediately prior to a team's 2 official flights. Event supervisors are strongly urged to return flight logs after inspection. Timers must follow and observe teams as they are winding their motors.
 - h. Teams may make up to a total of 2 official flights using 1 or 2 helicopters.
 - i. Teams will be given an 8-minute "Flight Period," starting when their first flight (trim or official) after check-in begins. Any flight beginning within the 8-minute period will be permitted to fly to completion. Participants may make adjustments/repairs/trim flights during their official 8-minute period. During their 8-minute flight period, all flights must be considered an official flight unless they are declared a trim flight prior to launch. Teams must not be given extra time to recover or repair their helicopter(s).
 - j. The timing official will measure and record the "Time Aloft" in hundredths of a second for each flight. Time Aloft for each flight starts when the helicopter leaves the competitor's hand and stops when any part of the helicopter touches the floor, the rotors no longer support the weight of the helicopter (such as the helicopter landing on a girder or basketball hoop) or the judges otherwise determine the flight to be over.
 - k. Event supervisors are strongly encouraged to utilize 3 independent timers on all runs. The middle value of the 3 timers will be the officially recorded time.
 - l. The Event Supervisor may permit other official flights during the flight of another team's helicopter.
 - m. Competitors must not steer the helicopter during flight. In the unlikely event of a collision with another helicopter, a team may elect a re-flight. The decision to re-fly may be made after the helicopter lands. The eight-minute period does not apply to such a flight.
5. **SCORING:** The base score is the team's longest single flight time. Ties will be broken by the longest non-scored flight time.
- a. Teams with incomplete flight logs must have 10% of their flight time deducted from each flight.
 - b. Teams without flight logs must have 30% of their flight time deducted from each flight.
 - c. Teams that violate a rule under "CONSTRUCTION" or "THE COMPETITION" that does not have a specific penalty must be ranked after all teams that do not violate those rules.

Recommended Resources: All reference and training resources including the **Helicopters DVD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

THIS EVENT IS SPONSORED BY THE ACADEMY OF MODEL AERONAUTICS

<http://www.modelaircraft.org/>



HEREDITY



Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

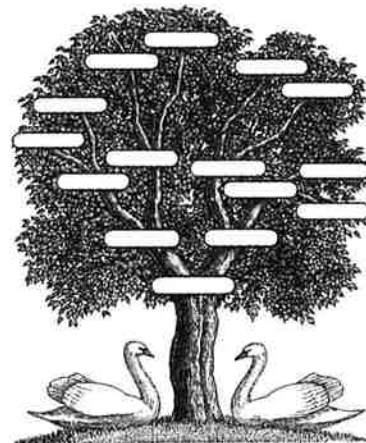
1. **DESCRIPTION:** Students will solve problems and analyze data or diagrams using their knowledge of the basic principles of genetics.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:** Each team may bring **only** one 8.5" x 11" two-sided page of information in any form from any source and up to two non-programmable, non-graphing calculators.

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



Regional and State	Regional and State	National (all topics)
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	Transcription and translation
Mitosis	Meiosis and gamete formation	Multifactorial traits
Human karyotypes analysis for nondisjunction disorders	Co-dominance & incomplete dominance	Epistasis

4. **SAMPLE QUESTIONS:**

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

Recommended Resources: All reference and training resources including the **Bio/Earth CD** and the in-depth **Genetics CD** are available on the Official Science Olympiad Store or Website at www.soinc.org



KEEP THE HEAT

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Teams must construct an insulated device prior to the tournament that is designed to retain heat. Students must also complete a written test on thermodynamic concepts.

A TEAM OF UP TO: 2 EYE PROTECTION: #4 IMPOUND: Yes APPROX. TIME: 50 Minutes

2. **EVENT PARAMETERS:**

- a. Competitors must bring their insulating device, 2 identical 250 mL Pyrex (or similar brand name) beakers, eye protection, plots and writing utensils and may bring any notes, parts/supplies, or type of calculators for use during any part of the competition. Notes of any kind must be 3-hole punched and secured in a 3-ring binder of any size, so that regardless of orientation nothing falls out.
- b. Event supervisors must supply the hot water, devices for transferring measured volumes from the water source to the team's beakers, and thermometers or probes (recommended).
- c. Prior to the day of the competition, the team must calibrate their devices by preparing plots (either on separate graphs or overlaid on the same graph) showing the relationship between elapsed cooling time and ending water temperature for various quantities of water and starting water temperatures. If hand drawn, they must be on graph paper. All plots must be properly labeled and marked to identify the team.
 - i. Teams may submit **up to 4 plots for scoring. Teams may be asked by the supervisor to submit them** prior to the tournament.
 - ii. Teams **are encouraged to** have a duplicate set to use, as those submitted may not be returned.
 - iii. Students must be prepared to answer questions about the data collection and how the plots are used.
 - iv. Example plots are available on the Keep the Heat page on www.soinc.org
- d. The team's device, parts and any supplies (beakers, tools, notes, plots, etc.) must be impounded before the event starts. Eye protection does not need to be impounded. Appeals by teams will not be processed after they remove their device from the competition area unless the appeals committee has released it.
- e. Competitors must wear splash rated eye protection during set-up and while loading their devices with water. They may remove it for Part 2 of the competition. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows, otherwise they will not be allowed to compete in Part 1.

3. **CONSTRUCTION:** The device must fit within a 20.0 cm x 20.0 cm x 20.0 cm cube.

- a. **Devices may be constructed of and contain any materials except for the following** prohibited materials: any type of foam (plastic, metal, expandable glue, etc.), bubblewrap, commercial insulation.
- b. Within the device, students must be able to easily insert and remove a 250 mL standard, unaltered, empty Pyrex (or similar brand name) beaker that they supply (height ~1.4 times the diameter).
- c. The device must also easily accommodate the insertion and removal of a thermometer/probe into the beaker via a hole at least 1.5 cm in diameter **all the way through** directly above the beaker. The top surface of the hole must be less than 2.5 cm above the top lip of the beaker. The hole must remain open **and unobstructed** during the competition.
- d. Devices must be inspected to ensure that there are no energy sources (e.g., no electrical components, small battery powered heaters, chemical reactions, etc.) to help keep the water warm. At the event supervisor's discretion, teams must disassemble their devices at the end of the testing period in order to verify the materials used in construction.
- e. All parts of the device must not be significantly different from room temperature at impound.

4. **THE COMPETITION:**

- a. **Part 1: Device Testing**

- i. After all devices are impounded, the event supervisors must announce the temperature of the source water bath (60 to 90°C), the volume of water to be used (100 to 200 mL, in 25 mL increments at Regional competitions, 10 mL at State competitions, 1 mL at the National competition) and the amount of cooling time allowed (20 to 40 mins.). These variables must be the same for all teams.
- ii. The event supervisor must also announce the current room temperature.

- iii. Teams must be given 5 minutes to setup/modify their devices at the start of the competition. **Devices that do not meet the construction specs must not be allowed to be tested until brought into spec.**
- iv. Each team, in a staggered sequence, must have the set amount of water poured into each of their 2 beakers, one of which they must then insert into their device, the other must be placed on an open surface next to the device. **Nothing must be placed under or immediately around the external beaker.** Teams may secure and/or close access panels with fastening materials after inserting the beaker. Event supervisors must record the time each team receives their water. **Teams may utilize their own thermometers to measure the starting water temperature in their beakers.**
- v. Teams must use their plots to calculate the temperature of the water in their beaker at the end of the cooling time. They must provide the event supervisors with their estimate **prior to beginning part 2.**
- vi. At the end of the cooling period, the event supervisor must record the temperature in each beaker to the best precision of the available instrument. Supervisors may leave thermometers/probes in the devices and the un-insulated beakers for the entire cooling period, but must announce if they will do so before impound. Otherwise they must first insert a thermometer/probe into the un-insulated beaker, wait at least **20** seconds, and record the resulting temperature. The event supervisor must then wipe any residual water off the thermometer/probe and repeat the same process with the beaker inside of the students' device. Multiple thermometers/probes may be used at the supervisor's discretion.

b. Part 2: Written Test

- i. Students must take a test on thermodynamic concepts **during** the remaining time after all devices have been loaded with water. All teams must have the same amount of time to take the test.
- ii. The test must be worth 50 points.
- iii. Topics may include: temperature conversions, definitions of heat units, thermal conductivity, heat capacity, specific heat, the laws of thermodynamics, the history of thermodynamics, and thermodynamic processes.

5. SCORING: High score wins.

- a. All scoring calculations are to be done in degrees Celsius.
- b. Penalties: **4 points each time a Competition section requirement is violated; 10 points for each Construction section requirement violation; 25 points for missing impound.**
- c. One of the submitted plots, selected by the event supervisor, must be scored as follows:
 - i. Partial credit may be given. The max Plot Score possible is 10 points.
 - ii. 2 points if labeled with school and student's names.
 - iii. 2 points for appropriate title of plot and X and Y-axis labels.
 - iv. 2 points for appropriate units and axis increments.
 - v. 1 point for each data plot on a graph or graphs turned in (up to 4 total).
- d. The final score is the sum of four components **minus penalties** (a scoring spreadsheet is at soinc.org):
 - i. Test Score = max of 50 points
 - ii. Plot Score = max of 10 points
 - iii. Heat Retention Score = $((\text{internal beaker water temp} / \text{external beaker water temp}) - 1) \times 25$ points
 - iv. Prediction Score = $(1 - (\text{abs}(\text{final internal beaker water temp} - \text{predicted internal beaker water temp}) / \text{final internal beaker water temp})) \times 50$ points
 - v. **If the heat retention score is negative, it must be set to zero for scoring purposes.**
- e. Scoring Example: A team gets 22 out of 25 questions on the test correct, submits 4 accurately labeled plots, and predicts the final internal beaker water temp will be 35.0 degrees C. The actual final internal beaker water temp was 32.1 degrees C and the external beaker had a final temp of 27.0 degrees C.

Test Score = $(22 / 25) \times 50 = 44$; Heat Retention Score = $((32.1 / 27.0) - 1) \times 25 = 4.7$;
 Plot Score = 10; Prediction Score = $(1 - (\text{abs}(32.1 - 35) / 32.1)) \times 50 = 45.5$;
 Total Score = $44 + 10 + 4.7 + 45.5 = 104.2$.

Recommended Resources: All reference and training resources including the Chem/Phy Sci CD are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** This event emphasizes understanding of basic meteorological principles with emphasis on interpretation and analysis of meteorological data.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 Minutes

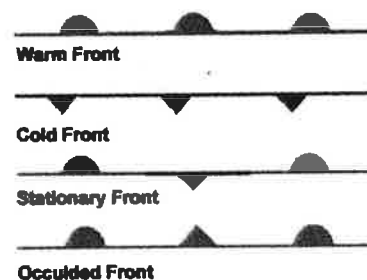
2. **EVENT PARAMETERS:** Each team may bring one 8.5" x 11" two-sided page of notes containing information in any form from any source.

3. **THE COMPETITION:** The questions will be from the following Everyday Weather topics:

- a. **The modern atmosphere:** structure, thickness, composition, seasonal variation, variable and permanent gasses, unique characteristics, and atmospheric pollutants
- b. **Solar Radiation and Seasons:** energy balance, atmospheric influences on insolation, surface/atmospheric energy transfer processes, diurnal and seasonal temperature patterns, Earth's revolution, rotation, axial tilt, and atmospheric beam depletion
- c. **Water and its properties as they relate to weather:** specific heat, density, sensible and latent heat
- d. **Air Masses:** origin, temperature, density, moisture, advection, and stability
- e. **Atmospheric moisture:** humidity, water vapor, cloud development and forms, precipitation types, formation, and hazards
- f. **Atmospheric pressure:** horizontal and vertical gradients, highs, lows, and fronts (warm, cold, occluded & stationary), ridges and troughs
- g. **Atmospheric circulation:** three-cell model, Coriolis Effect, friction, gradient winds, jet streams, etc.
- h. **Local wind patterns:** Chinook winds, sea breezes, valley and mountain breezes, Santa Ana winds, Alberta Clippers, panhandle hook, and similar regional weather patterns
- i. **Surface Weather Stations and Surface weather maps:** analysis, construction, and interpretation
- j. **Modern weather instrumentation and technology (use and interpretation):** thermometers, anemometers, barometers, satellite imagery, radiosondes, rawinsondes, Doppler radar
- k. **Weather forecasting:** analysis and interpretation of weather maps, meteograms, stuve diagrams, isopleths, fronts, Doppler, modeling, thermodynamic charts, and vertical atmospheric profiles
- l. **Atmospheric phenomena:** sundogs, rainbows, aurora, virga, crepuscular rays, green flash, etc.
- m. **Temperature indices:** wind chill, heat index, and heating and cooling degree days

4. **REPRESENTATIVE ACTIVITIES:**

- a. Examine a surface weather map of radar, fronts, and data and predict 24-hour weather trends.
- b. Examine surface weather stations on a U.S. Map and interpret local weather conditions.



5. **SCORING:** Points will be awarded for the quality and accuracy of responses, the quality of supporting reasons, and proper use of scientific technique. Highest score wins.

Recommended Resources: All reference and training resources including the **Audubon Weather (Meteorology) Guide** and **Bio/Earth CD** are available on the Official Science Olympiad Store or Website at www.soinc.org Also see: www.education.noaa.gov/Special_Topics/Science_Olympiad.html

THIS EVENT IS SPONSORED BY: The National Oceanic and Atmospheric Administration (NOAA)

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will estimate and then measure identical objects in metric units. The properties to be measured may include mass, volume, density, area, force, distance, time, and temperature.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 Minutes

2. **EVENT PARAMETERS:**

- This event will take place in one room (or two if needed) with between 15-30 stations. Students will rotate through the stations to make their estimations and then, using the same or identical objects, make their measurements. Measuring devices must be kept out of sight during the Estimation Part of the competition.
- Supervisors will furnish pencils and all measuring devices needed for the event.
- Teams **must not** bring watches, writing implements, electronic devices, notes or measuring devices of any kind (e.g., fingers, pieces of paper, pencils, clothing, etc.). **Each student may bring a non-programmable calculator for the Measurement Part only.**

3. **THE COMPETITION:** Note: The property to be estimated or measured and the units of the response must be identified in the supervisor's directions at **each station**.

a. **Estimation Part:**

- Teams will be given a form on which they will record their estimations. This form must be turned in before beginning the Measurement Part of the event or the team will lose the score for this Part.
- Students will rotate through the stations as directed by the supervisor. The recommended time at each estimation station is 30 seconds.
- Students may not touch, feel, or "heft" any of the objects, unless the station directions specifically state the object may be moved or touched.

b. **Measurement Part:** (Note: Prior to the competition supervisors are to determine the acceptable measurement/correct value with the same equipment that is to be used in the event)

- The teams will be given a second form on which they will record their measurements.
- The recommended time at each station for the measurement part is 60 seconds.
- Measurements will be made using the instruments supplied keeping in mind the instrument's resolution (the smallest actual graduation or markings on the instrument plus one estimated digit). An instrument's resolution will refer to the smallest divisions (markings/graduations) on its scale.
- To receive points, measurements must be expressed using the proper resolution and estimated digit appropriate for the instrument(s) provided (e.g., if an answer should be 9.0 cm and the answer given by the team is 9 cm, the answer will be marked wrong).



4. **SCORING:**

- Scores for both parts of the event will be rated according to the accuracy of the estimates or measurements. Rankings will be by highest combined score.
- For the Estimation Part, scores within 5% of the correct value, as determined by the event supervisor, will be awarded 5 points, within 10% will be awarded 3 points and within 20% will be awarded 1 point.
- In the Measurement Part, the correct measurements, as determined by the event supervisor, expressed to the instrument's resolution including one estimated digit will receive 5 points. Values will be considered correct at regional tournaments if the value is within (+/-) 3 of the estimated digit; at state tournaments if the value is within (+/-) 2 of the estimated digit; and for the national tournament if the value is within (+/-) 1 of the estimated digit. Example: If the national supervisor measures the width of a page as 209.1 mm using a ruler whose smallest divisions are 1 mm, then any value from 209.0-209.2 mm would be accepted as a correct answer. All others receive zero points.
- Penalties: A 10 point penalty will be given for each of the following team violations:
 - Does not return measuring devices to their original location.
 - Does not clean up any spills.
 - Alters the equipment (e.g., zeroing a balance or altering other equipment-may also result in DQ).
- Ties will be broken using pre-selected tiebreaker stations.

Recommended Resources: All reference and training resources including the **Problem Solving and Technology CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

MISSION POSSIBLE



Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Prior to the competition, teams must design, build, test, and document a "Rube Goldberg® like Device" that completes a required Final Task using a sequence of consecutive tasks.
TEAM: 1-3 **IMPOUND:** Yes **EYE PROTECTION:** #2 **SET-UP:** 30 minutes **MAX. RUN-TIME:** 3 minutes
2. **SAFETY PARAMETERS:** All team members must properly wear safety spectacles with side shields at all times. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows, otherwise not be allowed to 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 must receive only receive participation points.
3. **CONSTRUCTION PARAMETERS:**
 - a. All parts of the device must fit and stay within a 60.0 cm x 60.0 cm x 60.0 cm imaginary cube during its operation. **The only exception to this limit is the last movement of the final task.**
 - b. The device must be designed and constructed to consecutively execute a sequence of tasks selected by the team from the list in section 4.
 - i. The Starting Task must be designed as Task 4.a. and the Final Task must be designed as Task 4.m.
 - ii. No more than 8 additional Tasks (from 4.b. - 4.k.) plus the "special task" are counted for points between the Starting Task and the Final Task and these may occur in any order.
 - iii. After the Starting Task, the device must be designed to operate autonomously.
 - iv. Each task in the device must be designed to contribute to the completion of the Final Task except the use of switches to turn off previously used motors. Parallel and/or dead end tasks are not allowed.
 - v. **Each moveable/adjustable physical object in the device can only be utilized by one assigned task.**
 - vi. Other non-scoreable tasks may be incorporated into the device and must contribute to the completion of the Final Task. These tasks receive no points **but must be listed** on the Task Sequence List (TSL).
 - c. Electric components are limited to batteries, wires, mechanical switches, and/or up to three motors. No computers, integrated circuits, or any other unlisted electric components are permitted in the device.
 - d. Hazardous liquids, flames, and materials (e.g., rat traps, **lead objects, etc.**) are not permitted.
 - e. Power to any single electrical circuit must not exceed 10.0 volts. All batteries must be factory-sealed and voltage labeled by the manufacturer. Lead-acid batteries are not permitted.
 - f. Energy devices (i.e., batteries/mousetraps), except motors, may be activated prior to starting the device.
 - g. A team must be disqualified if the device is remotely timed or controlled.
 - h. **The top and at least one vertical wall must be open or transparent for viewing all actions and tasks.**
4. **THE TASKS:** Tasks receive points only if successful, listed on the TSL, and contribute towards Final Task completion within the 3-min time limit. A single action must contribute to only one scoreable task.
 - a. (100 pts) **Starting Task-** Initiate **the first action** by dropping a US quarter coin into the device from a **position higher than the entire device. This first action must not be one of the scorable tasks listed.**
 - b. (20 pts) **Open a closed plastic egg so the contents fall out and cause the next action.**
 - c. (20 pts) **Use the force of moving air to push an object at least a linear distance of 10 cm. The new position of the object must cause the next action.**
 - d. (20 pts) Turn a screw such that it moves an object at least 2.0 cm in the direction parallel to the screw's axis of rotation before causing the next action.
 - e. (20 pts) Release the energy stored in a spring (**not a mouse/rat trap**) such that it causes the next action.
 - f. (30 pts) Use a pulley system with an IMA greater than **2** to lift an object at least 5.0 cm before the object causes the next action.
 - g. (30 pts) Combine two levers of different classes into a system with an IMA greater than **5** to lift an object so **that the object causes** the next action.
 - h. (30 pts) Use a rack & pinion gear to move an object at least 5.0cm before **the object** causes the next action.
 - i. (40 pts) **Lift** an object with a 3rd class lever at least 15.0cm **above** where it starts. The lever must not touch the object at the beginning or end of this task. The final placement of the object must cause the next action.
 - j. (50 pts) **Move and pour granular material from one container to another container that is higher in the device. The entire initial container must be below the receiving container at task start but may be above the receiving container at task completion. The granular material in the receiving container must cause the next action.**
 - k. (50 pts) Use a gear system of at least 3 homemade, non-electrical, non-commercially constructed gears, **so that the final gear turns at least 360° and the turning of the final axle causes the next action.**
 - l. (20 pts + bonus) Special Task: Pull a mass up a ramp at least 10 cm (vertical), causing the next action. The **maximum angle of the ramp is 45°** measured from horizontal. Bonus points will be awarded based on both the mass raised and the height traveled. **The mass must be a solid mass and be easily removed.**



MISSION POSSIBLE (CONT.)

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- m. (200 pts) **Final Task - Raise a commercial 9V battery and up to an optional 10 dominoes** on a platform so that the surface of the platform is higher than any other part of the device. All 4 of the following conditions must be met: 1) The battery must be a 9 V battery and any dominoes are less than 4.5 cm x 2.5 cm x 0.8 cm; 2) The surface of the platform must be a flat, smooth, solid plane with no raised edges at all times. The item(s) must not be held or attached to any part of the platform. The use of materials or surfaces to increase friction is prohibited; 3) When the device is started the item(s) must be free-standing, the battery upright with the contacts up and any dominoes, if used, on their narrow long side. Items used must not be touching at the start. All items used must stay in contact with the top of the platform but after the start the item(s) may touch each other or fall over (not off the platform); 4) During the entire run nothing else must be on the platform.
5. **TASK SEQUENCE LIST (TSL):** The TSL details the sequence of tasks to occur during device operation.
- Tasks in section 4, intended to earn points, must be sequentially numbered and identified by letter in both the TSL and device. Non-scoreable actions or tasks must be listed in the TSL, but not be numbered.
 - The TSL must be submitted at impound and **must follow the specified format** posted on www.soinc.org.
6. **TIMING AND OPERATION OF DEVICE:**
- The ideal operation time for maximum points is 60.0 seconds at Regionals, between 60.0 and 90.0 seconds at States, and between 90.0 and 120.0 seconds at Nationals (time announced after impound).
 - Timing of the device begins when a team member **releases the quarter, dropping it into the device.**
 - Timing of the device stops when the final task is completed, which is when the platform comes to a complete stop or when 180.0 seconds elapses (whichever comes first).
 - If the device stops, jams or fails, the team must be allowed to “adjust” it to continue operation. Any obvious stalling to gain a time advantage must result in disqualification.
 - If an action inadvertently starts a task out of sequence on the TSL then all tasks skipped in the listed sequence must not earn points even if they are completed.
 - If the team completes a task themselves or makes an adjustment that leads directly to completion of the task in the next action, that task must not receive points (even if it is the final task).
7. **SCORING POINTS:** High score wins.
- Teams that impound a device but fail to compete receive participation points.
 - Points can only be earned for tasks successfully completed before 180.0 seconds elapses.
 - 2 pts for each full second of operation up to the ideal time.
 - 10 pts for self-measurement along a permanently installed ruler **awarded only once per each task (except 4.m.)** requiring movement of a certain distance or requiring an IMA. **Max. 80 pts.**
 - 25 pts** if the TSL is submitted **at impound.**
 - 25 pts** if the TSL uses the format specified. **See www.soinc.org website for an example TSL.**
 - 25 pts** if the tasks **in the TSL and** within the device are correspondingly labeled.
 - 25 pts if the TSL is 100% accurate in documentation of intended scoreable and non-scoreable tasks.
 - 50 pts if the team uses no more than 30 minutes to set up their device.
 - Point value listed for the first time each lettered task is successfully completed as indicated in section 4.
 - 1 pt for every 50 grams of mass lifted up the ramp in Special Task 1. Max 100 pts. (**5kg**)
 - 1 pt for every whole vertical cm the mass is raised in Special Task 1.
 - 1 pt for every **whole cm the top of the platform is lifted from its original, horizontal position by the device during the run. Points awarded even if platform does not leave the device. Max 150 pts.**
 - 25 pts for the battery and 2 pts for each domino not touching each other and remaining in their free standing, upright position on the platform during the run and after the platform comes to a complete stop.
8. **PENALTIES:**
- 1 pt for each full second that the device operates beyond the ideal time until Final Task completion or the 180.0-second time limit is reached (whichever occurs first).
 - 15 pts each time the device is touched, adjusted, or restarted.
 - 50 pts, one time, for any part or substance that leaves the boundary of the device during the operation **with the exception of the last movement of the final task.**
9. **TIERS:** Unsafe devices must not be allowed to run, and **teams will** receive only participation points.
- Tier 1: Devices without any violations.
 - Tier 2: Devices with competition violations other than those listed under penalties.
 - Tier 3: Devices with construction violations, parallel or “dead end” paths.
 - Tier 4: Devices impounded after the deadline.
10. **TIES:** are broken by this sequence: 1. Fewest penalty points, 2. Greatest **distance the platform is** lifted in the final task (only if the final task is completed), 3. Closest to ideal time.

Recommended Resource: The **Mission Possible DVD** and training resources are available at www.soinc.org



MOUSETRAP VEHICLE

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Teams design, build, and test one vehicle using one or two mousetraps as its sole means of propulsion to travel a distance as **quickly** and **accurately** as possible from a Start Point to a Target Point.
A TEAM OF UP TO: 2 **IMPOUND:** Yes **EYE PROTECTION:** #5 **APPROX. TIME:** 8 min
2. **SAFETY PARAMETERS:** Competitors must bring and correctly wear eye protection, ANSI Z87+ spectacles with side shields, while preparing and running their vehicle.
3. **CONSTRUCTION PARAMETERS:**
 - a. Vehicles must be designed to travel a **minimum of 8.50 m**, stay within a **0.75 m track width for the first 8.50 m**, and come to a complete stop as close as possible to a **Target Point**. The exact distance will be chosen by the Event Supervisor from between **9.00 m and 12.00 m**. At Regional competition the interval will be **1.00 m**, for State **0.50 m** and for Nationals **0.10 m**.
 - b. **The distance must not be announced** until all vehicles have been impounded.
 - c. **Up to 2** unmodified snap mousetraps (with a base less than 6.0 cm x 12.0 cm) may be used as the sole energy source. An unmodified mousetrap is one that still retains all of its original parts and structural integrity to function as intended. Altering the structural integrity of the mousetrap includes, but is not limited to, welding, bending, and cutting. Items, other than an extension bar attached to the snap portion, may not be added to the mousetrap. Soldering, taping, tying, gluing, or clamping the extension bar to the snap portion is allowed. Up to 4 holes may be drilled in the mousetrap for attachment to the chassis only.
 - d. All of the vehicle's kinetic energy must originate from the unmodified mousetraps. Items must not be added to the mousetrap to increase the potential energy of the unmodified mousetraps. Conversion of the mechanical energy of the mousetrap spring to **any other type of energy except kinetic energy to drive the vehicle is not permitted**.
 - e. The vehicle must have a paper clip attached to its front. The end point of the paper clip is used as the **Measurement Point** for distance measurements, it must be easily accessible to the Event Supervisor, **must extend out** beyond any other part of the vehicle (with the exception of the extension bar attached to the snap part), **and it must be bent** so that it extends down to within 1.0 cm of the track's surface.
 - f. In ready to start mode, the **entire** vehicle must be no more than **0.80 m** long and **0.30 m** wide. After it starts its run, **all dimensions except the width may change but at no time may any part of the vehicle extend higher than 0.90 m above the floor**.
 - g. **The vehicle must have a built-in fixed receptacle anywhere on the vehicle to hold a 1/4" x 1.0 m Event Supervisor provided wood dowel (mass between 10.0 and 25.0 g) vertical to the floor. If needed, students must provide their own materials to secure the dowel but they must not modify the dowel in any way. The dowel must be used to facilitate timing. Vehicles unable to accommodate the dowel will be allowed to run with the backup timers, but will be placed in Tier 3.**
 - h. Competitors must start the vehicle by actuating a trigger using an unsharpened #2 pencil, with an unused eraser (supplied by the Event Supervisor). The trigger must be designed so that its actuation is perpendicular (vertical) to the floor. A non-vertically activated trigger is a construction violation.
 - i. The wheels and drive string(s) are the only vehicle parts permitted to contact the floor at any time.
 - j. Stopping mechanisms must work automatically. The vehicle must not be tethered or remotely controlled.
 - k. Electrical components must not be used on the vehicle or its alignment devices.
4. **THE TRACK:**
 - a. The track must be on a smooth, level, and hard surface. Space is needed on each side of the track and beyond the **Target Point** to allow for error in the vehicle's path.
 - b. **The inside edge of the one-inch tape closest to the Start Point** must be used to define the track's Start Line, the **0.50m Line**, the **8.50m Line**, and **Side Lines up to the 8.50m Line**.
 - c. **The Start Point will be centered on the Start Line and marked on the inside edge.**
 - d. **The Target Point must be marked on an approximately 5 cm long x 1 inch wide piece of tape. The distance between the Start and Target Points must be measured to within 1 mm of the designated target distance.**
 - e. **If used, a photogate timing system must be installed at the 0.50 m Line and the 8.50 m Line at a height of approximately 0.95 m all tracks. See rule 5.n.**
 - f. At the Event Supervisor's discretion, more than one track may be used. Teams must be given the option to choose which track they will use. All runs by a team must be made on the same track.
5. **THE COMPETITION:**
 - a. The vehicle must be impounded before the start of the competition. Tools, data, and calculating devices need not be impounded.
 - b. Only competitors being judged are allowed in the vehicle impound and track areas while teams are competing.

MOUSETRAP VEHICLE (CONT.)

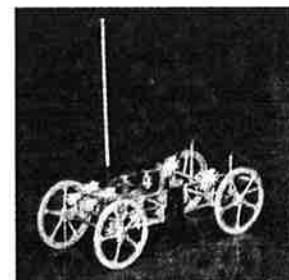
Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- c. Teams may not verify the distance by rolling the vehicle on the track surface between the start and finish line at any time prior to or during the competition.
 - d. All parts of the vehicle must move as a whole; no anchors, tie downs, launching ramps, or other separate pieces are allowed. The competitors must not hold, constrain, or give a push to the vehicle. If any piece falls off during the run, it is considered a construction violation. The vehicle must be able to remain at the starting position without being touched until triggered.
 - e. **The competitors may adjust the vehicle between runs but the Measurement Point must remain within 1.00 cm of the floor and be the foremost point with the exception of the extension bar.**
 - f. Teams have **8** minutes of Event Time to set up, **attach the supplied dowel**, make any adjustments (including adjusting the Measurement point), take measurements, and start two runs. If the second run has started before the **8**-minute period has elapsed, it must be allowed to run to completion. Time used by the Event Supervisor for run measurements must not count toward the **8**-minute Event Time.
 - g. Teams must place the tip of the vehicle's Measurement Point on the **Start Point** and align the vehicle.
 - h. Sighting and/or aiming devices placed on the track are permitted but must be removed before the vehicle runs. Aligning and sighting devices mounted on the vehicle may be removed at the team's discretion prior to each run.
 - i. Run Time **will be the time it takes for the vehicle to travel between 0.50 m and 8.50 m. It starts when the dowel of the vehicle reaches 0.50 m and ends when it passes the 8.50 m mark. The Run Time is measured to the nearest 0.01 s.** If a vehicle does not move upon actuation of the switch it does not count as a run and the team may request to set up for another run, but must not receive extra time.
 - j. If the vehicle moves any distance after actuation of the switch, it must be considered a run.
 - k. Once the vehicle starts a run the competitors must not follow it down the track and must wait until called by the Event Supervisor to retrieve it. The **8**-minute time resumes once they pick up their vehicle.
 - l. **If any part of the vehicle leaves the 0.75m track before it crosses the 8.50 m Line the run will be placed in Tier 2. After the measurement point passes the 8.50 m Line this penalty will not be implemented.**
 - m. If the vehicle **passes the 0.50 m Line but stops before the 8.50 m Line, the hand held timers record the stop time, measurement is taken, and it is scored as a Tier 2 run.**
 - n. Event supervisors must use **hand held timers** on all runs and are encouraged to also utilize a **photogate timing system for the primary time.**
 - o. If the time and/or distance cannot be measured for a vehicle (e.g., it starts before the Event Supervisor is ready, **if it moves but does not go at least 0.50 m**, the competitors pick up it before it is measured, or it travels in the wrong direction), the run is **ranked in Tier 2 with a score of 5000.**
 - p. Teams who wish to file an appeal must leave their vehicle with the Event Supervisor.
6. **SCORING:** Best low score wins.
- a. The Run Score = Distance Score + Time Score.
 - b. The Distance Score is the distance from the Measurement point to the Target Point in **centimeters measured to the nearest 0.1 cm.** This is a point-to-point measurement.
 - c. The Time Score = **Run Time x 5.**
 - d. The Final Score for the event is the run that gives the team the better rank.
 - e. **Tiers:** Teams are ranked using the single run that gives them the best overall rank.
 - i. Tier 1: A run with no violations.
 - ii. Tier 2: A run with competition violations. **Some examples of these would be any run that disrupts the photogate system, doesn't reach 8.50 m, or leaves the confines of the track before its measurement point passes the 8.50 m line.**
 - iii. Tier 3: A run with construction violations or both competition and construction violations.
 - iv. Tier 4: A vehicle that cannot complete any runs. (Participation points only)
 - f. Ties must be broken by this sequence: 1. Better non-scored run; 2. **Faster time on the scored run.**

SCORING EXAMPLE: At a competition, a team's vehicle stopped 155.3 cm from the Target Point with a Run Time of 5.79 s and stayed within the track.

Distance Score	155.3	cm
Time Score	28.95	(5.79 s x 5)
Run Score	184.25	

Recommended Resources: All resources including the **Mousetrap Vehicle DVD** are available on the Official Science Olympiad Store or Website at www.soinc.org





REACH FOR THE STARS

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will demonstrate an understanding and knowledge of the properties and evolution of stars and their observation with different portions of the electromagnetic spectrum: Radio, Infrared, Visible, Ultraviolet, X-Ray and Gamma Ray.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 Minutes

2. **EVENT PARAMETERS:** Each team may bring only two 8.5" x 11" two-sided pages of information in any form from any source and must provide their own clipboards and red-filtered flashlights.

3. **THE COMPETITION:** This event is divided into two parts. **Notes may be used during both parts.**

- a. **Part I:** 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.

Aquila: **Altair**, *CoRoT-2A*, *SS433*

Aquarius: *NGC 7293*

Auriga: **Capella**

Bootes: **Arcturus**

Canis Major: **Sirius**

Canis Minor: **Procyon**

Carina: *Eta Carinae*

Centaurus: **Proxima Centauri**

Cassiopeia: *Cas A*, *Tycho's Star*, *NGC 281*

Dorado: *30 Doradus*

Cygnus: **Deneb**, *Cygnus X-1*, *NGC 7000*

Gemini: **Castor & Pollux**, *Gemina*

Libra: **Gliese 581**

Hercules: *M13 Globular Cluster*

Leo: **Regulus**

Lyra: **Vega** & *M57 Ring Nebula*

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

Perseus: **Algol**

Sagittarius: *Sgr A*, *M17*, *G359.23-0.82*

Scorpius: **Antares**

Taurus: **Aldebaran**, **HL Tau**, *Hyades Star Cluster*, *M1 Crab Nebula* & *M45 Pleiades*

Ursa Minor: **Polaris**

Ursa Major: **Mizar** & **Alcor**, *SN1993J*

Vela: **γ Velorum**, *Vela Supernova Remnant*

Virgo: **Spica**

- b. **Part II:** Participants will be asked to complete one or more hands-on or interpretive tasks selected from the following topics:

- Stellar evolution
- Spectral classification of stars
- Observation using multiple portions of the electromagnetic spectrum
- The relationship between stellar temperature, radius, and luminosity

4. **SAMPLE PERFORMANCE TASKS:**

- Given the properties and/or spectra of stars and deep sky objects, participants will identify their proper placement on an H-R Diagram.
- Given a set of images observing a star or deep space object with different portions of the electromagnetic spectrum, identify which images correspond to which portion of the spectrum and describe what features are prominent in each observation and why.

5. **SCORING:** Each task and/or question will have been assigned a predetermined number of points. Places determined by total number of points. Ties will be broken by the accuracy and thoroughness of responses.

Recommended Resources: All reference and training resources including the **Audubon Field Guide to the Night Sky** and the **Bio/Earth CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org> Also See: <http://chandra.harvard.edu/>, <http://www.nrao.edu/> and <http://www.stsci.edu/hst/>, <http://www.spitzer.caltech.edu/>, <http://science.nasa.gov/missions/integral/>,



Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Participants will respond to 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:** Participants must bring a protractor, ruler, and may bring a USGS Map Symbol Sheet, a calculator, notes, reference materials, and other measuring devices. Computers are not permitted. The event supervisor will provide all required maps, question booklets, and response sheets.
3. **THE COMPETITION:** The highway and quad maps may be from one or more states. The event may be presented in a storyline format. Participants may be asked to draw map features located within a one square mile (1-mile x 1-mile) section using the correct features listed in 3.c. This square will be included on the answer sheet. Participants may not write on the maps.

a. **Topographic Map Testing Areas**

- i. Map location/series/scale/index/legend
- ii. Marginal information
- iii. Contours
- iv. Magnetic declination
- v. Map symbols
- vi. Map features
- vii. Survey control marks (control stations and spot elevations)
- viii. Azimuths and bearings
- ix. *Stream gradient (feet per 1000 feet)



- x. Distance values between features (both English and metric units)
- xi. Geographic coordinate system features and symbols (degrees, minutes, seconds)
- xii. Public Land Survey System (PLSS)
- xiii. Elevation of features and symbols
- xiv. *Slope (feet per 100 feet)
- xv. Sector Reference System
- xvi. Direction of stream flow
- xvii. *Profiles
- xviii. Graticule tick marks
- xix. *Universal Transversal Mercator (UTM)

b. **Highway Map Testing Areas**

- i. Distances between features
- ii. Map legend/tables/index
- iii. Map grid system
- iv. Map symbols
- v. City/Regional inserts on the highway map

c. **Student-Created Map Design**

- i. Map scales
- ii. USGS topographic map symbol
- iii. Distances
- iv. Azimuths and bearings
- v. Public Land Survey System

* Items marked with an asterisk should be written at an introductory level for regional exams.

4. **SCORING:** Teams will be ranked according to their point total. Values of questions may be weighted. Ties will be broken by the accuracy and/or quality of answers to pre-selected questions.

Recommended Resources: All reference and training resources including the **Road Scholar/Map Reading Coaches Manual on CD (RDCD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org> Also see USGS Science education: <http://education.usgs.gov/> and USGS Topographic Maps: <http://education.usgs.gov/common/secondary.htm#topographic>

1. **DESCRIPTION:** Teams will demonstrate their knowledge of rocks and minerals.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 40-50 Minutes

2. **EVENT PARAMETERS:** Each **team** may bring only one magnifying glass; one commercially published resource that may be tabbed and written in and one 3-ring binder (any size) containing pages of information in any form from any source. The pages must be 3-hole punched and inserted into the rings (sheet protectors are allowed).

3. **THE COMPETITION:**

- Equal time intervals, as determined by the supervisor, will be allotted for each station. When the start signal is given, participants will begin work at their initial station.
- Participants may not move to the next station until prompted to do so, may not skip stations, or return to any previously visited station.
- Specimens and other materials placed at the various stations may not be taken to other stations.
- HCl will not be provided, nor may it be brought to or be used during the competition. Written descriptions as to how a specimen might react were it to be tested with HCl may be provided.
- Only those specimens appearing on the **Official NSO list** (see www.soinc.org) will be used in the competition with the following exception: Tournament Directors may include up to five additional specimens important to their own state. If additional specimens are to be included, all teams must be notified **no later than three weeks prior to the competition**.

4. **Topics may include, but are not limited to:**

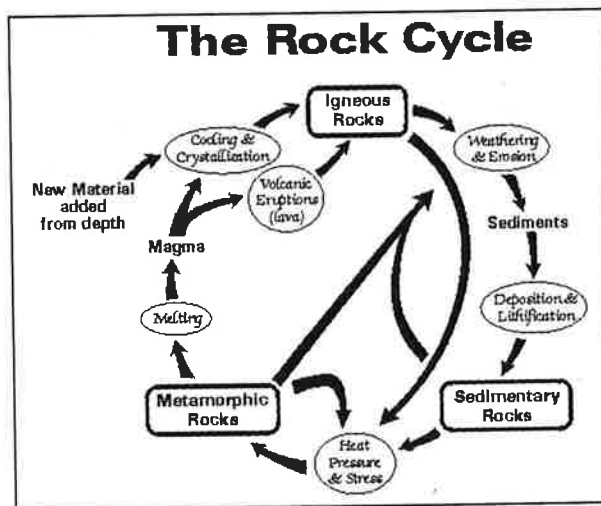
- Specimen identification
- Rock cycle
- Properties of minerals
- Mineral groups
- Economic importance
- Formation and properties of igneous, sedimentary, and metamorphic rocks
- Clues to past environments
- Composition and structure of minerals
- Bowen's reaction series

5. **REPRESENTATIVE STATION ACTIVITIES:**

- Using the materials provided, fingernails included, determine the relative hardness of each of these six minerals. List the specimens, by name and number, in order of increasing hardness.
- Match each metamorphic rock with the type of rock from which it may have been formed.

6. **SCORING:** Total scores will determine rankings in this event. Ties will be broken by the accuracy or quality of answers to selected questions.

Recommended Resources: All reference and training resources including the **Science Olympiad Rock & Mineral Teaching Guide**, the **Bio/Earth CD** and the **National Audubon Society Field Guide to North American Rocks and Minerals** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org> Also, **Rocks and Minerals kits** (*excluding only silver, gold, and diamond) may be purchased by check or School Purchase Order from ESES, P.O. Box 503, Lee's Summit, MO 64063 (No Credit Cards or Phone Orders-PH 816-524-5635; FAX 816-525-4263) item OLY01 at \$85.00. Price quoted includes shipping and handling.





ROTOR EGG DROP

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** A team will construct an unpowered, autorotation helicopter device, which uses one or more helicopter rotor(s) to safely transport a raw chicken egg from a specified height to the floor.

A TEAM OF UP TO: 2

IMPOUND: Yes

APPROXIMATE TIME: 10 minutes

2. **EVENT PARAMETERS:**

- a. Students may bring only one prebuilt helicopter egg drop device. No other tools or equipment are allowed. The device may be in a protective storage container for impound.
- b. The supervisor will provide a raw, Grade A, large chicken egg, a plastic sandwich bag, a 3oz paper cup, and masking tape to attach the cup to the device and seal the bag (if needed).

3. **CONSTRUCTION PARAMETERS:**

- a. The device must use wings or blades that rotate around a central axis to slow the descent of the egg, using aerodynamic principles of a helicopter rotor in unpowered "autorotation" mode. No energy-producing mechanism of any type may be used to power the rotor(s) to slow the descent of the device. No commercial rotor assemblies may be used. The device must not be or contain an airplane, a balloon, or a parachute.
- b. Students must seal the egg in the provided plastic sandwich bag and place it in the provided cup.
- c. Students must mount or suspend the cup from the bottom of the helicopter device in such a position that the cup will be the first thing to contact the floor. Students may use the provided masking tape to attach the egg and cup to their device.
- d. No other shock absorbing or cushioning materials may be used either inside (including trapped air) or outside the bag or cup to protect the egg before the cup contacts the floor.
- e. The entire device, including the cup in flying configuration, must fit into a 51 cm x 51 cm x 51 cm cube.

4. **THE COMPETITION:**

- a. It is recommended that the event take place indoors, but if the event is held outdoors, teams must be notified of the location prior to the tournament date.
- b. The entire helicopter must be impounded before the start of the event. No modifications are allowed after impound other than to attach or extract the egg and cup from the helicopter.
- c. If the egg is broken by the competitors before the drop, they may request another egg, with a penalty of two seconds subtracted from their final time.
- d. Teams will have only one drop. All teams must drop their device from the same designated height. The drop height will be announced on the day of the tournament. It is recommended that the drop height be the maximum that the site will accommodate with a minimum height of five meters.
- e. Time starts when the device leaves the student's hand and stops when any part of the device touches the floor or the judges otherwise determine the flight is over. It is suggested that three separate timers be used and the final time be the median (middle) of the three times. Timing should be to the nearest 0.01 sec.
- f. After the drop the student is responsible for extracting the egg from the cup and sandwich bag and handing it to the event supervisor for inspection. Those helicopters whose egg did not survive will be ranked below those that survived.
- g. A broken egg is defined as a crack leaving a wet spot on a paper towel.
- h. Once the device is removed after testing there can be no further challenges for scoring or ranking.

5. **SCORING:**

- a. Teams will be ranked by the greatest descent time within each Tier, greatest time wins.
 - i. Tier 1: Met construction/competition parameters and the egg survived.
 - ii. Tier 2: Met construction/competition parameters and the egg did not survive.
 - iii. Tier 3: Did not meet construction/competition parameters and the egg survived.
 - iv. Tier 4: Did not meet construction/competition parameters and the egg did not survive.
- b. The tiebreaker is the mass of the lightest helicopter (without the egg and cup).

Recommended Resources: All reference and training resources including the **Rotor Egg Drop DVD** (formerly Helicopter Egg Drop) are available on the Official Science Olympiad Store or Website at www.soinc.org

SHOCK VALUE

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Students will compete in activities involving basic understanding of electricity, magnetism and simple electrical devices.

A TEAM OF UP TO: 2

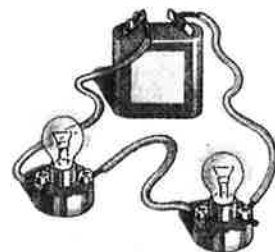
APPROXIMATE TIME: 50 minutes

2. **EVENT PARAMETERS:**

- Students are allowed to use any notes and/or calculators. Notes must be 3-hole punched and secured in a 3-ring binder of any size, so that regardless of orientation nothing falls out. Calculators must not have external probes or sensors of any type attached to them.
- The event supervisor must provide any needed measurement equipment such as multimeters or probes. Students may bring their own basic multimeters for use in place of event supervisor provided ones.

3. **THE COMPETITION:**

- The competition must consist of both hands-on tasks and questions related to electricity, magnetism and electrical devices such as light bulbs, batteries and motors. 50% of the score must be from the practical portion (hands-on tasks/applications), and 50% must be from the theoretical portion (written questions).
- Supervisors are encouraged to use measurement equipment (e.g., computer or calculator sensors/probes, multimeters, etc.) wherever possible or provide students with data sets collected by equipment following demonstration of the data collection. If used, data must be presented in a tabular and/or graphic format and students will be expected to interpret the data.
- The event supervisor may provide some mathematical relationships, but the students are expected to know and understand the concepts outlined below. The competition must consist of at least one task/question from each of the following areas:
 - Basic electrical DC circuit theory (e.g., concepts of voltage levels, current flow and direction, electrical pathways, volts, amperes, ohms, schematics, ohms law)
 - Basic electrical device concepts (e.g., battery polarity, parallel vs. series wiring of components, light bulb and motor connections, dry vs. wet cells). No semiconductors will be used.
 - Basic electrical circuit construction/analysis (e.g., switches, power source, voltmeter measurements, light bulb/motor connections, 'kitchen' built batteries)
 - Basic magnetism concepts (e.g., North and South poles, Earth's magnetic field, electromagnet principles, magnetic vs. nonmagnetic materials, magnet shapes/types)
 - Basic magnetic applications (e.g., use of a compass to determine directions/poles of a magnet, operation of an electromagnet, use of magnets in motors)
- Topics that must not be included in the competition are: semiconductors, AC circuit theory and devices, capacitors, inductors.



4. **EXAMPLES OF SHOCK VALUE STATIONS/ QUESTIONS:**

- The Event Supervisor provides circuit components including wires, batteries and a light bulb. Students will be asked to connect the components in such a way that that the light bulb shines the brightest it can.
- Students may be asked to draw a diagram of this circuit and label it and give a description of why this is the optimal configuration of this circuit.

5. **SCORING:**

- Points will be awarded for correct answers and/or proper technique.
- Ties will be broken using a designated task or question(s). The event supervisor will identify the tie breaker question(s) or task(s) on the answer form provided to the students at the beginning of the competition period. If more than one competition period is used, the tie breaker(s) will be the same for all periods.

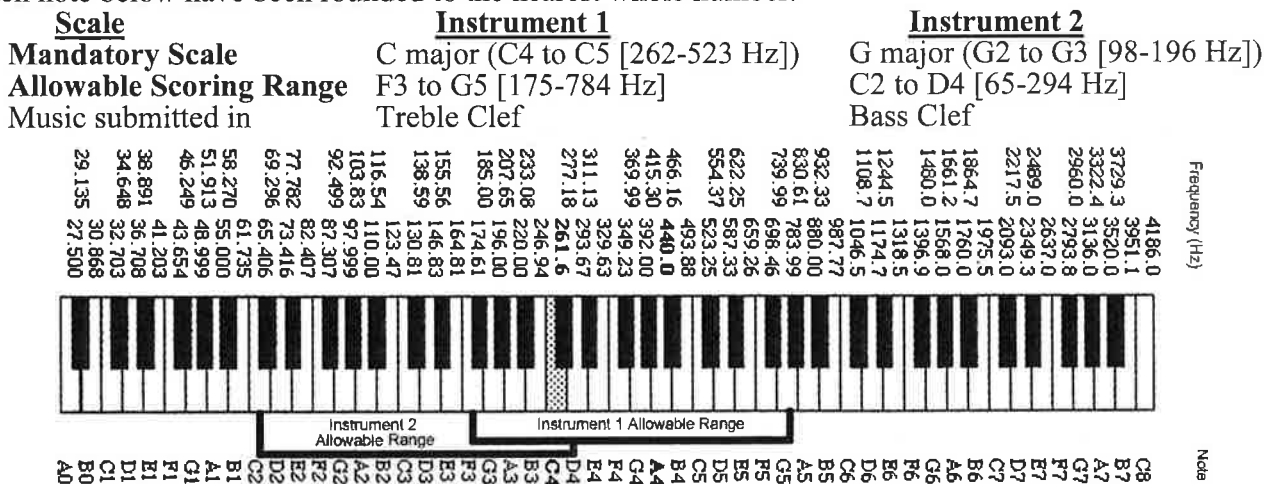
Recommended Resources: All reference and training resources including the **Chem/Phy Sci CD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>



SOUNDS OF MUSIC

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Prior to the competition each team must build two instruments, of any kind, based on a 12 tone tempered scale, prepare to describe the principles behind their operation and be able to perform a major scale, a required melody and a chosen melody with each.
A TEAM OF: 2 **EYE PROTECTION:** None Required **APPROXIMATE TIME:** 12 minutes
2. **EVENT PARAMETERS:**
 - a. Teams must provide a score of all music (both chosen and required) to be performed and submit it in notated form at the beginning of their presentation. Copies of this rules page must not be accepted.
 - b. All music must be written in the appropriate clef for each of the instruments as stated in the chart below.
 - c. Each competitor must play at least one instrument.
 - d. Notes, calculators, books, etc. must not be allowed for any portion of the judging. Sheet music is allowed.
3. **CONSTRUCTION**
 - a. Each instrument must be capable of playing the required lines as written or as transposed into a key adapted to their instrument but within the allowable range. Harmony for one instrument is required.
 - b. No electric or electronic devices, toy or professional instruments or parts of such instruments are permitted (e.g., bells, whistles, mouthpieces, reeds or reed blocks, audio-oscillators, rosin, tuning pegs, etc.). The only exception is that strings (instrument or others) of any type are permitted.
 - c. No electricity is allowed. All energy put into the instruments must originate from the competitors.
 - d. Instruments must be able to go through a standard 75cm wide door.
4. **THE COMPETITION:**
 - a. Once competitors enter the judging room, they will be given at least 30 seconds (maybe more if the supervisor allows) to setup before judging begins (there is a 5 point bonus if ready in ≤ 30 seconds).
 - b. **Part 1: Instrument Evaluation and Accuracy** (~ 2 minutes to judge)
 - i. Instruments must be evaluated on creativity/originality, variety, and functionality (ease of play, durability, musicality, etc.) through an interview process.
 - ii. Competitors must play a supervisor specified note from the required scale, which must be judged for accuracy. The note must be able to be sustained for at least 3 seconds in order to be measured by an electronic or computer based tuner.
 - c. **Part 2: Range and Sound Quality** (~ 1.5 minutes to judge)
 - i. Each competitor must have at least 30 seconds to play the Mandatory scale as given in the following chart and must be evaluated on range, pitch, and sound quality.
 - ii. Range will also be evaluated on range size. Instruments capable of playing above and/or below the mandatory scale but within the allowable range will receive more points. Corresponding frequencies for each note below have been rounded to the nearest whole number.



- d. **Part 3: Sound of the Ensemble** (~ 4 minutes to judge)
 - i. The team must then perform, in any key within the musical ranges specified, the lines of music included below. The piece must be played as a duet including melody and harmony. Competitors must supply their own harmony. The performance is limited to a total of 90 seconds.
 - ii. They must also play a duet of their choosing which best demonstrates their instruments' capabilities. The performance is limited to a total of 90 seconds.
 - iii. Points for both songs must be based on harmony, blend, technique, timbre, suitability of tune for instruments, rhythm, interpretation of music, etc.
 - iv. Competitors must be given a maximum of 4 minutes to play both the required duet and the chosen duet.

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

- e. **Part 4: Knowledge** (~ 4 minutes to judge)
- The competitors must be asked to describe age appropriate scientific principles used in the design and construction of their instruments (e.g., How it makes sound; What determines the pitch; How is volume changed, etc.).
 - This must be done as an oral interview and/or with a written set of questions involving both competitors, with the same 4 pre-selected questions adaptable to various instruments.
 - Competitors must be able to define or explain basic terminology regarding sound, sound production, and related science terms. These include the fundamental elements of wave theory, Bernoulli Effect, acoustics, musical sound perception, and harmonics.
5. **SCORING:** A complete scoring rubric is available on the Sounds of Music page on www.soinc.org
- All scoring must be done by the same set of judges (preferably 3). If more than one person is judging, each judge must score the same parts of the competition for all teams.
 - Each scoreable item listed below is worth a max of 5 points. All sections must be added for the total score (max possible score is 100 points).
 - Judges must collectively have knowledge of both music and the physics of sound.
 - Part 1: Instrument Evaluation and Accuracy** (Judge 1) (20 points total max)
 - Originality/creativity (traditional/unusual) 5 points max
 - Varieties of instruments used 5 points max
 - Functionality (easy to play, durability, musicality, etc.) 5 points max
 - Accuracy of specified note 5 points max
 - Part 2: Range and Sound Quality** (Judge 1) (20 points total max)
 - Demonstrated range (for instrument #1) 5 points max
 - Sound quality (compared to standard instruments #1) 5 points max
 - Demonstrated range (for instrument #2) 5 points max
 - Sound quality (compared to standard instruments #2) 5 points max
 - Part 3: Sound of the ensemble** (Judge 2) (20 points total max)
 - Group performance for the required song 10 points max
 - Group performance for the chosen song 10 points max
 - Part 4: Knowledge** (Judge 3) Includes participation of both team members. (20 points total max)
 - Each of the 4 total questions 5 points max each
 - Other scored items:** (20 points total max)
 - Teams that furnish music for the judges with team name and number 5 points max
 - Teams that write their music in the correct clefs and correctly notated 5 points max
 - Teams that play all music in the correct range 5 points max
 - Teams that are ready to be judged within 30 seconds of entering the room 5 points max
 - Teams that violate a rule in the Construction section must be ranked behind all other teams that do not.
 - Tiebreaker: 1st, score on part 4: knowledge; 2nd, range of instruments
 - Required Song: "Theme Movement #2 New World Symphony", shown below
 - Competitors must transpose music into a suitable key to fit the assigned ranges of their instruments. Suggested tempo is *largo* ♩64.



Recommended Resources: All reference and training resources including the **Sounds of Music DVD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

WATER QUALITY

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** The event will focus on evaluating aquatic environments.
A TEAM OF UP TO: 2 **EYE PROTECTION:** #4 **APPROXIMATE TIME:** 50 Minutes
2. **EVENT PARAMETERS:** Each team may bring **only one 8.5" x 11"** two-sided page of notes that contains information in any form from any source, **one student built salinometer/hydrometer for testing** and up to 2 non-programmable, non-graphing calculators. Each participant must bring Z87 chemical splash goggles.
3. **THE COMPETITION:** This event will be composed of three sections of approximately equal point value. This may include analysis, interpretation or use of charts, graphs and sample data. Supervisors are expected to utilize freshwater "lakes, ponds, or rivers" and **estuary** scenarios and have students analyze and evaluate comparative macroinvertebrates, and water quality data. In subsequent years this event will cover estuarine and ocean ecology. Process skills may include equipment use, collecting and interpreting data, measuring, calculating, classifying, and making inferences.
 - a. This section will use multiple choice, matching, fill-in-the-blank and/or short answers 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 and webs, community interactions, population dynamics, watershed resource management issues, sedimentation pollution and harmful species.
 - b. Macro-flora and fauna Section will include the identification (common name only) of immature and adult macroinvertebrates and aquatic nuisance organisms, their importance as indicators of water and wetland quality. In addition Division C will also be expected to know the general ecology, life cycles, and feeding habits of all listed organisms.

Class 1-pollution sensitive	Class 2-moderately sen.	Class 3-moderately tolerant	Class 4-pollution tol.	Class 5 Air Breath.
Mayfly	Aquatic Sowbug	Water Mite	Air Breathing Snail	Whirligig Beetle
Caddisfly	Damselfly	Midge	Deer/Horse Fly	Water Strider
Stonefly	Dragonfly	Blackfly	Tubifex	Mosquito
Dobsonfly	Scuds	Flatworm	Blood Midge	Giant Water Bug
Gilled Snails	Crane Fly	Leeches		Back Swimmer
Water Penny				Water Boatman
Riffle Beetle				Predacious Diving Beetle
Water Scorpion				

Aquatic Nuisance Plants: Purple Loosestrife, Eurasian Water Milfoil and Water Hyacinth
 Aquatic Nuisance Animals: Zebra Mussel; Spiny Water Flea, Asian Tiger Mosquito and Carp

- c. **Water Monitoring and Analysis Section** - Students 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 and biochemical oxygen demand and their relationship to one another. Actual testing will be limited to salinity. Teams must build, calibrate, bring and demonstrate a salinometer/hydrometer capable of measuring **saltwater (most likely NaCl) concentrations between 1-10% (mass/volume)**. **All types of salinometers are permitted but may not use commercially made meters or their parts.** Teams should be able to estimate percent to the nearest tenth. Full credit will most likely be given ± 1 at Regionals and ± 0.5 at State/Nationals. Points for salinity testing should be approximately 5% of the total score.
4. **SCORING:** Questions will be assigned point values. Students will be ranked from highest to lowest score. Ties will be broken by pre-determined tiebreaker questions.

Recommended Resources: All reference and training resources including the in-depth **Water Quality CD** and the **Bio/Earth CDs** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

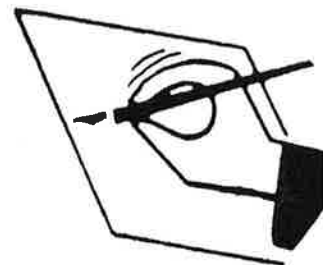
1. **DESCRIPTION:** One student will write a description of an object and how to build it, and then the other student will attempt to construct the object from this description.

A TEAM OF: 2

APPROXIMATE TIME: 55 Minutes

2. **THE COMPETITION:**

- a. A student is shown an object (which may be abstract and 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., Googplex, K'nex, Tinker Toys, Lego, Lincoln Logs, etc.).
- b. The student 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. Only numerals, words and single letters may be used. Symbols, drawings and diagrams are not allowed, with the exception of common punctuation and editing symbols. Printable punctuation marks/editing symbols that can be produced on a PC standard 101 key keyboard by pressing a single key or a single key in combination with the shift key may be used. These must be used in their normal context and not as symbols to form a key/code. All abbreviations (not symbols) must be defined either at the beginning or when the abbreviation is first used. No prepared abbreviations on labels will be permitted.
- c. The supervisor of the event will pass the description to the remaining team member who will take the description and attempt to recreate (build) the original object in twenty (20) minutes.
- d. Supervisors will attempt to use different materials than the materials that were used last year.



3. **SCORING:**

- a. The team that builds the object nearest to the original and has properly written instructions is declared the winner.
- b. Points will be given for each piece of material placed in the proper connection and location compared to the model.
- c. Pieces that are connected correctly beyond the incorrect connection will be counted in the score. No penalty will be assessed for parts that were not used.
- d. Scoring Violations: Use of diagrams or drawings will result in disqualification. A one percent (1%) penalty will be assessed for each minor infraction (e.g., unlabeled abbreviations or improper use of editing symbols or codes). Scoring Example: If a team has seven infractions and the total possible score is 50, then the team score would be $46.5 = 50 - [7(50 \times 0.01)]$.
- e. Time for the construction phase will be used as a tiebreaker.

Recommended Resources: All reference and training resources including the **Problem Solving and Technology CD** are available on the Official Science Olympiad Store or Website at www.soinc.org