ELEMENTARY SCIENCE OLYMPIAD
March 2, 2019
Case Western Reserve University

HANDBOOK AND RULES
GENERAL INFORMATION

• Sears 350 will serve as Olympiad Headquarters for coaches who have questions or concerns. Only coaches should enter Sears 350.

• Only competing participants with wrist bands are permitted in the competition spaces. Please do not enter contest areas for other events.

• Breakfast items can be purchased from 8:00 am – 11:30 am at Einstein’s Bagels in Nord Hall. Lunch can be purchased from 11:30 a.m. to 2:30 p.m. in the MARKET PLACE on the lower level of Tomlinson Hall. Food and beverages are also available from vending machines located throughout campus.

• Campus tours and conversations with admissions counselors are available throughout the year by calling the Undergraduate Admissions Office at 216/368---4450.

COMPETITION RULES

Team rosters and participation: Each team can have a maximum of 25 students, with no more than 12 sixth graders per team. The remaining students may be either fourth or fifth graders. There are no alternates allowed. While individual students will be allowed to represent their school and compete in most events Write It Do It and Starry, Starry Night require full teams in order to participate.

Coordinating individual events: As a condition of participation, each team is required to captain/sponsor one event. A building sending two teams to the competition will be responsible for captaining/sponsoring two events. This includes setting up equipment and judging for the duration of the event. During registration, teams will select three possible events they could run and events will be assigned on a first come, first served basis. CWRU will provide undergraduate student volunteers on the day of the competition to assist with running each event.

Event descriptions: In an ongoing attempt to address concerns and integrate suggestions for the continued success and smooth running of the Olympiad, please read ALL event descriptions very carefully. Changes may have been made from year to year in the rules or scheduling of an event. Event captains/sponsors, judges, and volunteers will be responsible for monitoring and enforcing the event descriptions and guidelines as described in this handout including required safety gear.

Resources allowed during competition: Some events permit students to use additional resources such as field guides or reference sheets. Just prior to the start of each event, captains/sponsors, judges, and volunteers will verify each team is in compliance with the specific rules and guidelines regarding resources for their event.
**Scheduling:** We will use a scheduling system similar to those used at regional, state, and national competitions. Some events are scheduled for a fifty [50] minute block and all teams compete simultaneously during this block. Please be prompt, as judges have the right to refuse entrance to late teams. Teams that arrive on time should not be penalized by having to wait for late arrivals from other teams.

Other events (walk---in) are scheduled throughout the day and teams are assigned specific hour---long blocks to compete. In very rare instances where times must be rescheduled due to equipment breakdown, loss of electricity, and other unforeseen events, adjustments will be made by the captains/sponsors, judges and/or Olympiad coordinator (Jim Bader, CWRU) to ensure fairness among the teams.

**Scoring:** We will use the same scoring system used in Div B and C regional, state, and national competitions. First place teams receive one point, second place two, and so on. Final team rankings will be based on lowest cumulative score. Science Bowl (a head to head event) will not count toward the overall team score.

**Assistance:** No coach, parent, or judge may assist a team once the event has begun. Such assistance will result in disqualification of the team in that event.

**Complaints/Concerns:** Competition inquiries should be made only by the head coach [not parents] to Jim Bader, Olympiad coordinator in Sears 350. Students and parents do not always relate complete and accurate information to coaches, so it would be helpful if a coach receiving complaints would thoroughly inquire about the nature of the complaint before contacting the coordinator.

**Final Note:** Above all, competitors, coaches, parents, and judges are expected to conduct themselves in the spirit of the Science Olympiad and with the utmost level of sportsmanship. All participants will be respectful of each other and of the space (home rooms, auditoriums, facilities, competition areas) as university classes and Olympiad events will be in progress.

The Elementary Science Olympiad is made possible through the support of the Ohio Space Grant Consortium and the Leonard Gelfand STEM Center
1. **DESCRIPTION**: Understand the anatomy and physiology of the skeletal and muscular human body systems.

**A TEAM OF UP TO**: 2  
**APPROXIMATE TIME**: 50 min

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

3. **THE COMPETITION**: The test is limited to the following topics:  
   a. **SKELETAL SYSTEM**  
      i. Bones of the axial and appendicular skeleton; label the basic surface anatomy of a bone as shown on a diagram and/or normal X-ray, CT scan, or MRI.  
      ii. Name, structure and function of joint types and muscle and ligament attachments that surround the joints and the ranges of motion allowed by each (e.g., ball and socket).  
      iii. Structures of bones in cross section.  
      iv. How to distinguish between different types of vertebrae (e.g., cervical, thoracic, lumbar).  
      v. Label the bones of the skull.  
   b. **MUSCULAR SYSTEM**  
      i. The interaction of the skeletal and muscular systems to allow movement.  
      ii. Muscle fibers – the cellular and gross anatomy of skeletal muscle, cardiac muscle, and smooth muscle.  
      iii. How the skeletal muscles move bone, maintain posture, and produce heat.  
      iv. Location and identification of the major skeletal muscles of the body including origin, insertion, and function.

4. **SCORING**  
High score wins.
BRIDGE BUILDING

1. **DESCRIPTION**: The objective of this event is to design and build the lightest bridge with the highest structural efficiency capable of supporting a load up to 10 kg over a given span. Each team may enter only one bridge. Teams should also maintain and submit a notebook describing the process they used to design and test their bridge. The notebook should include simple sketches of each tested design, the mass supported by that design, and notes on the design changes made after each test.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 10 mins  
   **IMPOUND**: Yes

2. **THE COMPETITION**
   a. The bridge is to be a single wood structure bonded by glue. No other materials may be used. Particleboard, plywood, beaverboard, or any other composite wood products, bamboo, or paper may not be used anywhere in the construction.
   b. The entire bridge must be composed of pieces of wood no larger than ¼ inch thick (if square or rectangular) or ¼ inch in cross section (if round). There is no limit to how long each individual piece can be and any type glue may be used.
   c. Construction must be completed prior to impoundment on the day of the competition
   d. The bridge must be designed to span a space of 35 cm and to accommodate the testing apparatus (see section 3a below). There is no limit to how long the bridge can be, but it cannot be more than 10 cm wide at any point along its length.

3. **TESTING**
   a. The bridge will be placed so it spans the distance of 35 cm between two tables. No part of the bridge may extend below the plane of the table prior to loading. A crosspiece will be placed at the center of the highest point of the bridge, perpendicular to the long axis of the bridge. The crosspiece is made of a ruler with a hook inserted through the center hole. A 5-gallon bucket will be suspended from the hook inserted through the center hole.
   b. Students have a maximum of 10 minutes to add sand to the coffee can. If the time expires, the bridge will be scored using the mass of the sand that has been loaded when time expires.
   c. Sand will be poured into the coffee can until the bridge topples, folds, or collapses as determined by the event captain and judges.

4. **SCORING**
   The score will be determined by the Structural Efficiency equation:

   \[
   \text{Structural Efficiency} = \frac{\text{Load supported (grams)}}{\text{Mass of the bridge (grams)}}
   \]

   Bridges that meet all structural specifications will be ranked in the first tier. Bridges that do not meet all the structural specifications will be tested, but ranked behind bridges in the first tier.
1. **DESCRIPTION**: Students will compete in activities involving basic understanding of electricity, magnetism, and simple electric devices.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 50 mins

2. **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. The competition must consist of at least one task/question from each of the following areas:

   a. Basic electrical DC circuit theory (e.g., concepts of voltage levels, current flow and direction, electrical pathways, volts, amperes, ohms, and ohms law).
   b. Basic electrical device concepts (e.g., battery polarity, parallel v series wiring of components, light bulb and motor connections).
   c. Basic electrical circuit construction/analysis (e.g., switches, power source, voltmeter measurements, light bulb/motor connections).
   d. Basic magnetism concepts (e.g., North and South poles, Earth’s magnetic field, electromagnet principles, magnetic v nonmagnetic materials).
   e. 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).

3. **EXAMPLES OF CIRCUIT WIZARDY STATIONS/QUESTIONS**
   a. Captains may provide circuit components including wires, batteries, and light bulb. Students could be asked to connect components in such a way that the bulb shines the brightest it can. Students may also be asked to draw and label a diagram of their circuit.
   b. Students may be asked to connect components in such a way that the light bulbs light in a series or parallel circuit.
   c. Students may be asked to draw and label a diagram of their circuit and asked to explain why this is the optimal configuration for this circuit.

4. **SCORING**: Points will be awarded for correct answers and/or proper technique. An answer must be totally correct to receive credit. No credit for partially correct answers (if a circuit includes ABC and a team lists AB, it receives no credit).
CRIME BUSTERS

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**
   a. Students may bring only these items: small containers or reaction plates for mixing; something for scooping reagents; pH paper, magnet, hand lens, microscope slides and cover slips, forceps or tweezers. Each team may bring one 8.5”x11” two sided page of notes containing information in any form from any source. No other items are allowed. There is no penalty for not bringing these items, but the team may be at a disadvantage.

   b. The event captain will provide: iodine reagent (iodine dissolved in KI solution), 1 M HCl, and a wash bottle with distilled water. The captain may elect to provide additional equipment (such as a microscope, calculators, probes) or reagents to perform additional tests.

3. **THE COMPETITION**: There will be 3 parts and then the Analysis of the Crime. Questions can only be asked on the evidence found at the Crime Scene, so for instance, if DNA was not one of the pieces of evidence found at the crime scene, no questions about DNA can be asked.

   a. Qualitative analysis: The unknown common materials will be taken from the following lists.
      i. Solids: Anhydrous sodium acetate, sand, calcium carbonate (powdered limestone), vitamin C (ascorbic acid), cornstarch, baking soda, powdered gelatin, powdered Alka-Seltzer®, yeast.
      ii. Non-powdered metals: Aluminum, iron, zinc, magnesium, copper, tin.
      iii. Liquids: Lemon juice, rubbing (isopropyl) alcohol, household ammonia (3%), water, vinegar, hydrogen peroxide (3%).

   b. Paper chromatography: Students will demonstrate their skill in collecting evidence from paper chromatography one type of material (ink pens, juices, Kool-Aid®, etc). No calculations are expected to be performed.

   c. Crime scene physical evidence: Students will demonstrate their skill in collecting and/or analyzing evidence from a variety of 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 or electropherograms from materials found at the scene to those of the suspects.

iii. Shoeprints. Students are expected to be able to compare prints and make conclusions such as whether the subject was walking or running.

iv. Tire treads. Students are expected to be able to compare prints and make conclusions such as direction of travel.

v. Spatter. No calculations are expected to be performed.

d. 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. Questions may include but are not limited to who is/are the prime suspect(s), who is/are not suspects, and sequencing of events. It is expected that conclusions made will be supported by reference to specific evidence and/or testing.

4. **SAMPLE QUESTIONS:** The collected evidence and other data given could be used in a mock crime scene analysis to solve a crime problem. A scenario will be developed such as the following: a bank robber enters the bank and hands the teller a note which says, “Give me all your money.” The robber escapes with the money, but a white powder remains. Later, suspects are brought in. Chromatographic analysis of the ink from their pens is performed in order to identify the robber. Each suspect’s white powder is compared with the powder found at the crime scene, and so on.

5. **SCORING**

a. Team with the highest score wins. Time will not be used for scoring. The score will be composed of the following elements (percentages are approximate): 3a = 50%, 3b = 15%, 3c = 10%, and 3d = 25%.

b. Ties will be broken by the analysis of the crime scene.

c. A penalty of up to 10% may be given if the area is not cleaned up as instructed by the event supervisor.
DISEASE DETECTIVES

1. **DESCRIPTION**: Students will use their investigative skills in the scientific study of diseases, injury, health, and disability in populations or groups of people with a focus on food borne illnesses.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 50 min

2. **EVENT PARAMETERS**: Each team may bring one 8.5” x 11” two sided page of notes that contain information in any form from any source and a non-programmable calculator.

3. **THE COMPETITION**
   a. This event contains 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.
   b. A broad definition of health will be used for this event. Potential topics include health as well as illness (physical, infectious, chronic, environmental, genetic).
   c. The event will include questions based on:
      i. Data collection
      ii. Creating graphic displays of data
      iii. Interpreting trends and patterns of epidemiologic data
      iv. Communicating results
   d. Students will be presented one or more descriptions of a public health problem such as an outbreak of food poisoning, a cluster of cases of West Nile virus, or state data on bicycle injuries.
   e. Based on these descriptions students will be expected to
      i. Generate hypotheses and recognize various fundamental study designs
      ii. Evaluate data by calculating and comparing simple rates and proportions
      iii. Identify patterns, trends, and possible modes of transmission, sources of risk factors.
      iv. Propose interventions based on promoting positive health behaviors or disrupting clearly identifiable chains of transmission.
   f. They will also be expected to
      i. Define basic epidemiological and public health terms (e.g., outbreak, epidemic, pandemic, etc.)
      ii. Recognize various categories of disease causing agents and give examples of illnesses caused by each.
      iii. Recognize and understand differences between the major groups of infectious agents (e.g., viruses, bacteria, protistans, fungi).
   g. Process skills may include hypothesis, observations, inferences, predictions, variable analysis, data analysis, and conclusions.
   h. The level of questioning should reflect the age-appropriateness of the group (4-6 grade).

4. **SCORING**
   a. Points will be assigned to the various questions and problems. Depending on the problem, scoring may be based on a combination of answers including graphs/charts, explanations, analysis, and closed-ended responses to specific questions.
   b. Points should be awarded for both quality and accuracy of answers, the quality of supporting reasoning, and the use of proper scientific methods.
1. **DESCRIPTION**: Identify insects from seven orders and answer questions related to them.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 50 mins

2. **THE COMPETITION**:

   These seven orders will be used: Orthoptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera, Odonata and Hemiptera. Teams will not be allowed to bring in any field guides or source books. The seven orders will be clearly posted in the room. At some stations, a field guide will be provided for students to use.

   a. The first section will include 20 insect identification stations where students will identify the insects to its order, or identify the specimen as "not an insect." Photos, drawings and preserved or living specimens may be used. (20 pts.). Many of the stations will include a follow up multiple choice question related to the natural history or biology of that insect (10 pts.).

   b. The second section will include open-ended questions relating to knowledge about the listed orders (adaptations, habitat, body parts, food chain relationships, etc.) (20 pts.).

3. **SCORING**:

   Teams are ranked according to the number of correct responses. One point will be awarded for each correct insect identification (to order, or “not an insect”). One point will be awarded for each correct multiple choice question. Up to twenty points will be awarded for correct answers in the open-ended question section.
EGG DROP

1. **DESCRIPTION**: Design the lightest container to keep a raw egg from breaking when dropped from increasing heights.

   **A TEAM OF UP TO**: 2  **BUILDING TIME**: 50 min  **TESTING TIME**: 10 min  **IMPOUND**: Yes

2. **MATERIALS**
   a. Each team will be given a container of building materials. All containers will contain the same materials. The contents may include, but are not limited to, paper cups, drinking straws, popsicle sticks, wooden splints, tongue depressors, string, masking tape, rubber bands, pipe cleaners, bubble wrap, etc. This is only a sample list and the actual materials supplied may be different.
   b. Only those materials in the container may be used to build the device. The container may not be used.
   c. At the conclusion of the building period, devices will be impounded and may not be modified further.

3. **THE COMPETITION**
   a. The first block of the day (9:00-9:50) is reserved for building egg devices. Your team must build their egg devices during this period. All participating students will report to the assigned room and pick up their construction materials and assemble their egg devices at that time. The same students who build the device must be the ones to test it.
   b. Each team will be supplied a Commercial Standard Grade "A" (Large Size) chicken egg. The egg cannot be tampered with or altered physically or chemically. The egg will be inspected before handing it to the student. After the egg is handed to the student it is considered to be in play. If the egg is damaged or broken during construction or any other time prior to the drop the team will be disqualified from this event.
   c. The Event Captain will weigh the devices prior to testing.
   d. The egg will be placed in a clear sandwich bag in order to contain any mess, but nothing else may be in the bag with the egg, or added to the bag prior to placement in the project. The bag may not be cut or altered in any way nor may it be inflated or used as a building material.
   e. The egg may not be completely encased or sealed within materials as to make it invisible to the judges. The egg must be easily inserted and removed by the judges. Judges must be able to completely examine the egg without deconstructing essential portions of the device. Other than replacing the egg, no other adjustments may be made between drops, no additional materials may be added, including tape.
   f. Each team will drop their egg up to four times from four different heights from the steps in the Nord Atrium as directed by event judges.
   g. If the egg cracks or breaks for any reason, it is out of the competition.

4. **SCORING**
   The score will be determined by subtracting the weight of the device (in grams) from the last height the egg survived (in cm). We are going to ignore the fact that grams cannot be subtracted from centimeters. Teams with a building violation (such as taping the egg to the device in way the judges can not easily remove the egg) will be placed in the second tier behind those teams in full compliance. Teams with multiple violations will be placed in the third tier. All teams in the first tier will place ahead of teams in the second tier and second tier teams will be placed ahead of third tier teams.
EXPERIMENTAL DESIGN-
MYSTERY ARCHITECTURE

1. **DESCRIPTION:** Use a given set of materials and instructions for designing and building a device that can be tested.

   **A TEAM OF UP TO:** 2  
   **APPROXIMATE TIME:** 50 mins

2. **EVENT PARAMETERS:**
   Each team may bring 1 pair of scissors, 1 linear measuring device, and 1 pair of pliers. No other materials, tools, notes or resources are permitted.

3. **THE COMPETITION:**
   a. Each team will be given a bag containing the same materials and instructions as to the type of device to be constructed. The students will not know the task until they begin the competition.
   b. Examples of materials that may be provided include, but are not limited to: paper cups, drinking straws, paper clips, string, tape, paper, thumbtacks, and craft sticks. Only those materials contained in the bag may be used to build the device. The bag and instructions must not be used. No other materials or adhesives may be part of the finished device.
   c. The devices to be built are limited to a tower or bridge.
   d. The instructions must identify a Primary Dimension, a Secondary Dimension, whether the device must support a load, and the required duration of load support.
   e. Unless specifically stated in the instructions, devices must be freestanding and must not be attached to a tabletop, floor, ceiling or other support.
   f. If the device must support a load, a separate identical load of the same dimensions and weight as used for testing must be provided to each team. When finished building, students must remove the load from their device. When directed by the event supervisor, the students will place the official load in/on the device.
   g. Only participants and the event captain are allowed in the event area. Once in the event area, they must not leave or receive outside assistance, materials, or communication.
   h. The captain will review with the team the data being recorded on their scoresheet.

4. **SAMPLE TASKS & PRIMARY DIMENSIONS:**
   a. For a tower, the Primary Dimension could be measured:
      i. with no load, to the flat top of the tower,
      ii. with a load, to the top of the supplied load.
   b. For a bridge, the Primary Dimension could be measured between the closest inside supports. If the bridge fails to support the load, the Primary Dimension will be measured from the point of contact to the farther inside support.

5. **SCORING:**
   a. Highest or lowest score wins depending on construction instructions.
   b. The Primary and Secondary Dimensions will be measured in cm to the nearest 0.1 cm by the Event Captain. Devices requiring a load will be measured both prior to and after placement of the load and after the duration time, if successfully held.
   c. Devices with no load requirements will be ranked in order of Primary Dimensions as per construction instructions.
   d. Devices with load requirements will be ranked as follows:
      i. Tier 1: Devices which support the load will be ranked in order of Primary Dimensions after the placement of the load.
      ii. Tier 2: Devices which do not support the load will be ranked by Primary Dimensions as measured before the placement of the load. Not supporting the load is defined as the load or its underlying material making contact with the table or inability of the event supervisor to measure the height due to movement
iii. of the load.
e. The Secondary Dimension will be used as a Tie Breaker if necessary.

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

6. a. to develop a testable question using the provided materials, fill out the lab
report, and conduct a simple experiment that will yield results.

7. **SCORING:**
   a. Students will be scored using a rubric.

   b. Judges will be looking for:
      i. A testable question
      ii. A reasonable hypothesis
      iii. Inclusion of all necessary materials
      iv. Precise and repeatable method
      v. Validity of results
      vi. Well-developed conclusion

   c. Points will be deducted if students do not
      clean up their area upon completion.
HERPETOLOGY

1. **DESCRIPTION:** Identify amphibians and reptiles found in Ohio and answer questions about the life science of various specimens.

   **A TEAM OF UP TO:** 2  
   **APPROXIMATE TIME:** 50 min.

2. **THE COMPETITION:** Questions will relate to the identification of amphibians and reptiles found throughout Ohio and information about their natural history and biology (adaptations, habitat, biology, food chain relationships, vocalizations, ecology, current events, etc.). Each station will include identification (from photo or specimen) with one follow up question. Additional stations will include identifying vocalizations and open-ended questions. Students should bring a copy of the Amphibian and Reptile identification guides available for free from the Ohio Division of Wildlife (1-800-WILDLIFE). No other guides or resource books will be permitted.

3. **SCORING:**

   One point will be awarded for each correct identification.
   One point will be awarded for each correctly answered follow up question.
   One point will be awarded for each vocalization correctly identified.
   Up to five points will be awarded for one or two open ended question(s).

   **Tie breaker:** Spelling and open ended questions answered with complete sentences.
1. **DESCRIPTION:** Participants will demonstrate their understanding of climate and how it is measured. The emphasis will be on the weather conditions measured over the long term to determine climate conditions.

   **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. Each participant may bring any kind of non-graphing calculator, but no other resources.

3. **THE COMPETITION:** The following topics are to be addressed in the competition:
   
   a. Composition and evolution of Earth’s atmosphere*
   b. Weather vs Climate
   c. Clouds and Precipitation*
   d. Forces and Winds*
   e. Air Masses and Fronts*
   f. Weather Forecasting*
   g. Severe Storms*
   h. Hurricanes*
   i. El Nino, La Nina
   j. Solar Radiation and Earth’s Energy Balance
   k. Hydrologic Cycle*
   l. Human Impact on climate

4. **SCORING:** Points will be awarded according to the quality and accuracy of responses. Highest score wins. Pre-identified questions will be used as tiebreakers.

**SAMPLE RECOMMENDED RESOURCES:**

- **On Line Guides: Meteorology**  
  http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/home.rxml

- **Understanding How the Weather Works**  
  http://www.weatherworks.com/

- **Audubon Weather (Meteorology) Guide**  
  http://www.audubon.org/search_results?search=meteorology

- **NOAA**  
  https://library.noaa.gov/Research-Tools/Subject-Guides/weathersites

- **American Meteorological Society**  
  http://www.ametsoc.org/amsedu/dstreme/
1. **DESCRIPTION**: Teams students will use various devices to make numerous estimates and measurements expressing their answers in metric units.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 50 mins

2. **THE COMPETITION**
   a. Each team of students will move through stations twice, the first time for 30 seconds to estimate and the second time for 1 minute to make actual measurements. Each station will contain the equipment and materials needed to make a measurement or measurements or a set of questions. Students may be quizzed on the various units of the metric system and the conversion among prefixes (100,000 cm = 1 km, for example).

   b. All measurements will be made and recorded in metric units. Students are expected to record all digits know with certainty and one estimated digit (Law of Significant Figures). Simple calculations may be necessary to determine the answers at some stations. Calculators will be provided (no outside calculators allowed).

   c. This will be a timed event with 30 seconds allowed at each station for the first pass and 1 minute for the second pass. Students must move at the indicated time to ensure that all teams have an equal opportunity to use the equipment at each location.

   d. An answer sheet will be provided for each team to record their estimates. A second answer sheet will be provided when teams transition to the actual measurements.

3. **SCORING**
   The scoring of the event will be based on the accuracy of the estimates and the number of correct responses. Ties will be broken with the accuracy of estimates and correct responses on pre-determined tie-breaker questions.
MOUSETRAP VEHICLE

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

   **A TEAM OF UP TO**: 2

   **APPROXIMATE TIME**: 10 min

   **IMPOUND**: Yes

2. **CONSTRUCTION GUIDELINES**
   a. Vehicles must be designed to travel exactly 10 m, come to a complete stop without straying from the centerline and be as close as possible to their predicted time.
   b. Only one unmodified snap mousetrap (with a base less than 6.0 cm x 12.0 cm) may be used as an energy source. An unmodified mousetrap is one that still retains all its original parts and structural integrity to function as an actual mousetrap. Altering the structural integrity of the mousetrap includes, but is not limited to, welding, bending, or cutting. Soldering, taping, tying, gluing, and/or clamping an extension bar to the snap portion is allowed. Up to four (4) holes may be drilled in the mousetrap for attachment to a chassis only.
   c. All the vehicle’s energy must originate from the unmodified mousetrap spring. Items must not be added to the mousetrap to increase potential energy of the unmodified mousetrap. Conversion of the mechanical energy of the mousetrap spring is permissible, but any additional sources of kinetic energy must be at their lowest states at the beginning of the run.
   d. The vehicle must have the point of a bent paperclip that serves as a measurement point attached to the front of the chassis that extends down to within 1 cm of the track’s surface. The point of the paperclip nearest the track surface is used as the reference point for distance measurements.
   e. The complete vehicle must be no more than 1.0 m long and 0.35 meters wide. There is no restriction on the height of the vehicle.
   f. Competitors must start the vehicle by triggering the mousetrap using an unsharpened #2 pencil with an unused eraser (supplied by the Event Captain). No alteration of the original mousetrap trigger is allowed.
   g. The wheels and drive strings are the only vehicle parts permitted to make contact with the floor at any time.
   h. Stopping mechanisms must work automatically. The vehicle must not be tethered or remotely controlled. No electrical components can be used on the vehicle or its alignment devices.

3. **THE TRACK**
   a. The competition track will be a tiled hallway in a building on the CWRU campus.
   b. On the day of the competition, a track will be laid out using masking tape. The track will have a centerline, starting line, and target line 10 m from the starting line.

4. **THE COMPETITION**
a. All vehicles will be impounded at the beginning of the day.
b. 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 push 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.
c. Before the first run, the competitors must predict their vehicle’s Run Time. They are not allowed to change the prediction for the second run, but they may adjust the vehicle.
d. Teams have 10 minutes to set up, make any adjustments, take measurements, and complete two runs.
e. 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.
f. Run Time starts when the vehicle begins forward motion and ends when the vehicle comes to a complete stop. If the vehicle does not move upon actuation of the switch, it does not count as a run, but the team does not receive any extra time to complete its two runs.
g. If the vehicle moves any distance after actuation of the switch, it must be considered a run.
h. Event supervisors will use at least two (2) independent timers on all runs. Final Run Times will be an average of all judges.

5. **SCORING:** Low score wins
   a. The Run Score = Distance Score + Time Score + Centerline Bonus + Predicted Time Score.
   b. The Distance Score is the distance from the measurement point on the vehicle to the Target Line (in mm).
   c. The Time Score = 10 x (Run Time)
   d. A Centerline Bonus of -20 pts is awarded if the center tape (1” masking tape) remains completely within the vehicle’s track (between the wheels) during the whole run.
   e. The Predicted Time Score = 10 x |(Predicted Time-Actual Travel Time)|

**SCORING EXAMPLE:** At a competition, a team’s vehicle stops 103 mm from the Target Line. It made the run in 7.86 seconds, kept the Centerline within the vehicle’s track with a predicted time of 6.79 seconds.

| Distance Score | 103 |
| Time Score     | 78.6 (10 x 7.86 sec) |
| Centerline Bonus | -20 |
| **Predicted Time Score** | 10.7 (10 x |(6.79 – 7.86)|) |
| Run Score      | 172.3 |
MYSTERY DESIGN EVENT

1. **DESCRIPTION**: Students will design an item that solves a problem with materials and guidelines supplied by the captain/sponsor.

   **A TEAM OF UP TO**: 2
   **APPROXIMATE TIME**: 50 mins

2. **THE COMPETITION**
   There are no rules for this event other than being familiar with the engineering design process. Teams will be provided a scenario, a set of materials that is identical for all teams, and time to design, test, revise, and prepare for final testing before the session concludes.

   **Resources for design practice prompts**: http://pbskids.org/designsquad/
1. **DESCRIPTION:** Students will position mirrors to direct a laser beam towards a target and will be tested on their knowledge of geometric and physical optics.

   **A TEAM OF UP TO:** 2  **EYE PROTECTION:** None  **APPROX. TIME:** 50 Minutes

2. **EVENT PARAMETERS:**

   a. All reference materials to be used during all parts of the competition must be initially secured in a 3-ring binder so that regardless of orientation none can fall out
   b. Competitors may bring any measuring tools, pre-made templates, writing utensils, and any calculators for use during any part of the competition. Student must NOT bring lasers or mirrors.

3. **LASER SHOOT SET UP:** The event captain must provide the Laser Shoot Setup (LSS) including laser, mirrors, and barriers. Example event setups are available at [www.soinc.org](http://www.soinc.org)
4. THE COMPETITION:

Part I: Written Test
a. Unless otherwise requested, answers must be in metric units with appropriate significant figures.
b. Teams must be given a minimum of 20 minutes to complete a written test.
c. Questions may be multiple choice, true-false, completion, or calculation problems.
d. The competition must consist of at least two questions from a minimum of five of the following areas:
   i. Law of Reflection: specular, diffuse
   ii. Refraction: index of refraction
   iii. Prism: deviation, dispersion
   iv. Convex, concave, and plain mirrors: ray tracing, focal length, real object, images (real/virtual, erect/inverted, magnification)
   v. Convex and concave lens: ray tracing, focal length, real object, images (real/virtual, erect/inverted, magnification)
   vi. Operating principles of optical equipment: microscopes, telescopes, cameras, glasses
   vii. Visible spectrum: primary/secondary colors, additive/subtractive, absorption/reflection
   viii. Structure and function of the parts of the human eye
   ix. Polarization of light using polarizing films or by scattering
   x. Optical absorption spectra: films, chemicals, dyes

Part II: Laser Shoot

e. The objective is to reflect a laser beam with mirrors around barriers towards the Target Point.
f. The event captain must select a Target Point location that is the same for all teams. Teams must not be informed of the location until it is their turn to compete in Part II of the event.
g. All mirrors must be placed in a home position designated by the event supervisor before each team is permitted to see the LSS.
h. When a team is ready to begin, the event supervisor must give a countdown of 3.2.1. start and start a timer. Event captains must give teams a warning when three minutes have elapsed.
i. Competitors must make all measurements, calculations, and mirror placement/alignment within a four minute time period. Competitors may choose to use between 1 and 5 moveable mirrors.
j. Timing must stop when four minutes have elapsed or competitors remove the material covering the face of one mirror. Competitors must not make any additional adjustments to the mirrors at that point other than to remove the other mirror coverings. The event captain must not remove the coverings.
k. Competitors must not mark on or modify the LSS.
l. Competitors must not touch the laser or change its orientation and/or position.
m. The laser must not be turned on until timing stops. Once turned on, the event captain must mark on the paper mounted above the metric scale where the laser strikes it to record the results. Competitor tools/templates may remain on the LSS during this
The event captain must verify with the team the correct recording of Part II data on the team scoresheet.

5. **SCORING:** A scoring rubric can be found on the event page at [www.soinc.org](http://www.soinc.org)
   a. Test Score (TS) = (Part 1 score/Highest Part I score of all teams) x 50 points.
   b. Mirrors Score (MS) = #moveable mirrors the laser reflects off of x 4 points. The maximum possible is 20.
   c. Accuracy Score (AS) = (25 – (accuracy (in mm)/10)) points. The smallest possible AS is 0.
   d. The accuracy is the horizontal distance from the Target Point to the center of where the laser strikes a wall. If the laser strikes another wall instead of the wall the Target Point is on, the accuracy is the sum of the straight line measurements from the Target Point to the corner along one wall and along the other wall from the corner to the laser dot.
   e. If the laser does not strike a wall, AS is 0, but the MS and BS should still be calculated.
   f. Teams that are disqualified for unsafe operation receive an AS, MS and BS of 0, but must be allowed to compete in Part I.
   g. The AS, MS, and BS must be multiplied by 0.9 when calculating the Final Score if the team violates any of the rules in THE COMPETITION.
   h. Barrier Score (BS) = 5 points if the laser reflects off the barrier mirror
   i. Final Score (FS) = TS + MS + AS + BS. The maximum possible FS is 100 points. High score wins.
   j. Ties are broken using designated question(s) on the written test. The supervisor must identify the tie breaker to the competitors at the beginning of the competition period.

**Recommended Resources:** All reference and training resources including the Chem/Phy Sci CD are available on the Official Science Olympiad Store or web site at [www.soinc.org](http://www.soinc.org);
[https://www.youtube.com/watch?v=E9AvjUi6ciI&list=PL1t-RzwejD0367jBDDod1Cri65jHNPb6](https://www.youtube.com/watch?v=E9AvjUi6ciI&list=PL1t-RzwejD0367jBDDod1Cri65jHNPb6)
[https://www.youtube.com/watch?v=E9AvjUi6ciI](https://www.youtube.com/watch?v=E9AvjUi6ciI)
[https://www.soinc.org/optics-b](https://www.soinc.org/optics-b)
1. **DESCRIPTION:** This event is about chemical properties and effects of specified toxic and therapeutic chemical substances, with a focus on household and environmental toxins or poisons.

   **A TEAM OF UP TO:** 2

   **EYE PROTECTION:** C (yes)  
   **APPROX. TIME:** 50 minutes

2. **EVENT PARAMETERS:**

   Each team may bring writing utensils, two calculators of any type dedicated to computation, and five 8.5”x11” sheets of paper that may contain information on both sides in any form and from any source. Other items not listed are prohibited. The event captains will check each team’s kit, confiscate non-allowed items, and have the right to penalize a team up to 10% if additional items are in the kit.

   Participants must bring and wear goggles/safety glasses, an apron or lab coat, and have skin covered from the neck down to the wrist and toes. Gloves are optional: but if a host requires a specific type they must notify teams. Shoulder length or longer hair must be tied back. Participants who unsafely remove their safety clothing/goggles or are observed handling any material or equipment in an unsafe manner will be penalized or disqualified.

3. **THE COMPETITION:**

   **PART I: Written Exam**
   a. This part will be a multiple-choice and short answer test covering the following: ionic and covalent bonds; the difference between mixtures, solutions, and compounds; how to separate components of a mixture; distinguishing between physical and chemical changes; balancing a simple chemical equation; identifying various poisonous plants and animals and their toxic effects; using a map, analyze the potential patterns of spread of toxic spills in the environment via water, wind, or gravity; the effects and chemistry of common household toxins; the effect of dilution on toxicity. The test is limited to information on: Household chemicals, toxic living organisms, environmental toxins

   **PART II: Lab**
   b. Participants will perform at least one lab activity by themselves. Other lab activities may be performed as a demonstration at the discretion of the event captain. Lab activities may include: chromatography; mixtures of reagents; separation of a mixture; serial dilutions; determination of pH; conductivity testing; observation of changes in color, temperature, production of a gas or precipitate after reagents have been mixed together by either themselves or the supervisor; calculation of the rate of a chemical reaction or other parameters; and identification of a particular change as either a physical or chemical change.

4. **SAMPLE EXAM QUESTIONS/ACTIVITIES:**
   a. What hazardous chemical may be produced if you mix household bleach with ammonia?
   b. What are the major sources of lead which causes lead poisoning?
   c. What should you do if you find a Jimsonweed plant (nightshade family)? Why is it dangerous?
   d. You stir together sand and salt. Is this mixture a solution or a compound? How might you separate the salt and sand again?
5. SCORING:
High score wins. Test questions from Part I are worth 60% of the overall score. Lab questions from Part II are 40% of the score. Selected questions along with the quality of free response answers may be used as tie breakers.

Recommended Resources:
The Science Olympiad Store (store.soinc.org) carries the Chem/Phy Science CD;
http://mypage.iu.edu/~lwoz/socrime/index.htm
http://www.astro.wisc.edu/~wakker/ScienceOlympiadResources/PotionsAndPoisons/PotionsAndPoisons_2016_CoachClinic.pdf
https://www.sciencenc.com/resources/middle-school/potions-poisons/;
READY, AIM, FIRE!

1. **DESCRIPTION:** Prior to the competition, teams design, construct, and calibrate a device that uses only the energy of a falling counterweight to launch a projectile as far and accurately as possible.

   **A TEAM OF UP TO:** 2

   **APPROXIMATE TIME:** 15 mins

   **IMPOUND:** Yes

2. **EVENT PARAMETERS:**
   a. Prior to the day of the competition, the team must calibrate their devices by preparing up to 5 plots showing the mass of various projectiles or counterweights vs distance. If they are hand drawn, they must be on graph paper. All plots must be properly labeled and marked to identify the team submitting them.
      i. Teams must have a duplicate set of plots to use during the competition, as those submitted will not be returned.
      ii. Students must be prepared to answer questions about the data collection and how the plots are used.
   b. Teams may also submit an example calculation page showing how to use the plots to position the target for a hypothetical counterweight and projectile.
   c. The team’s device, parts and any supplies (tools, notes, copies of graphs, etc.) must be impounded before the start of the event.
   d. The event supervisor will supply the projectiles, counterweights, and targets. The mass of the counterweights will be 1 kg and 2 kg. The mass of the projectiles will not be announced until all the devices are impounded.
   e. Competitors must wear eye protection during set up, testing, and launching. Teams without proper eye protection will not be allowed to compete.

3. **CONSTRUCTION:** The entire device, including the projectiles and counterweights must fit into a 65 cm x 65 cm x 65 cm cube when in the ready to fire position.
   a. The triggering device is not considered part of the device. It must extend out of the launch area and does not need to return to the launch area after launch. Battery triggered devices are allowed; radio controlled devices are not. The triggering device must not pose a danger to anyone due to flying parts or excessive movement out of the launch area.
   b. The device must be constructed to accommodate the counterweights and projectiles. Neither the counterweights nor projectiles may be modified.
   c. The two separate counterweights will consist of a 1 kg and 2 kg mass with a hook on top. Each hook and counterweight together must fit inside a 15 cm cube. If the hook is used to attach the counterweight to the device, the device must be able to accept a standard 1” open hook bolt.
   d. Projectiles must have a mass of 20-40 g for the lighter counterweight and 40-60 g for the heavier counterweight. The projectiles must be approximately spherical with a diameter not exceeding 6 cm. Dangerous projectiles must be avoided.
   e. The device, without the counterweight and projectile, must not contribute energy to the launch.

4. **THE COMPETITION:** Only competitors, the event supervisor, and volunteers are allowed in the impound and competition areas while teams are competing. Once the teams enter the competition area, they must not receive any outside assistance.
   a. When instructed by the event supervisor, teams must place their device anywhere within a marked perimeter of a 1.0 m x 1.0 m square designated as the Launch Area and must not anchor it to the ground.
   b. Except for the triggering mechanism, no part of the device and counterweight may extend out of the Launch Area before it is triggered or after the launch motion is complete. Any part of the device or counterweight that extends out of the launch area during the launch must return to rest with the Launch
Area without assistance.
c. The target must be an open-topped container with a minimum dimension of 20 cm x 20 cm x 20 cm.
   i. Before the first launch with each counterweight, the team must announce the position of the
target in 0.5 m increments. The event supervisor will set the target so the two sides of the
target are parallel with a straight line from the center of the Launch Area to the center of the
target.
   ii. If they hit the target, the team may request it moved to a new target distance (in 0.5 m
increments).
   iii. Event supervisors must indicate each projectile’s first point of impact. After each launch the
event supervisor will indicate when the competitors may approach the target to make
measurements and calibrate their device, which is included in the team’s 5 minutes.
d. The device may be moved anywhere within the Launch Area between launches.
e. During the launch, competitors may not touch or hold the device or be in the launch area or the area in
front of the line that marks the front edge of the launch area. They may touch only the part of the
triggering device that extends outside the launch area.
f. Teams have 5 minutes to make 4 launches (2 with each counterweight). No practice shots may be
made. Competitors must give ample warning to the event supervisor prior to each launch. It must not
count as a launch if the competitors attempt to initiate a launch and the device does not complete the
launch motion.
g. Time event supervisors spend moving the target or measuring distances does not count against the
teams 5 minutes.
h. Devices may be modified in any way allowed by the rules while the clock is running in order to make
successful launches. Only the tools, parts and supplies impounded may be used during the competition.
i. If a part of the device does not return to within the Launch Area on its own, the device may be repaired
or repositioned and subsequent launches scored normally.

5. **SCORING**: All measurements must be made and recorded in meters to the nearest 0.01 meter.
a. The Launch Score (LS) for each launch is calculates as LS = TD – 3A + B
   i. The Target Distance (TD) is the distance requested by the competitors and is measured from
the center of the Launch Area to the center of the target.
   ii. The Accuracy (A) score is the straight-line distance from the projectile’s point of first impact
to the target center.
   iii. The Bonus (B) is 0.15 x TD if the projectile hits the target at first impact or 0.30 x TD if at
first impact lands and stays in the target.
   iv. If the projectile hits the target on the first impact, the Accuracy (A) score is zero.
   v. If any part of the device leaves the Launch Area and does not return, the LS for that attempt is
0.
b. One of the submitted plots, selected by the event supervisor, will be scored as follows:
   i. The max Graph Score (GS) is 12.
   ii. Two points if labeled with the school and students’ names.
   iii. Two points for appropriate title of plot and X and Y axis labels.
   iv. Two points for appropriate units and axis increments.
   v. One point for each data plot on a graph or graphs turned in (up to 5 total).
   vi. One point for an example calculation page turned in.
c. The Final Score = Best LS (light counterweight) + Best LS (heavy counterweight) + GS
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 and ruler. Participants may bring a USGS map symbol sheet, a calculator, notes, reference materials, and other measuring devices. Computers or any internet-capable devices are not permitted. The event supervisor will supply 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 storyline format. Participants may be asked to draw map features located within a square mile section using the correct features listed in 3c. This square will be included on the answer sheet. Participants may not write on the maps.

   **a. Topographic Map Testing Areas**

   i. Map locations, series, scale, index, legend  
   ii. Marginal information  
   iii. Contours  
   iv. Map symbols  
   v. Map features  
   vi. Survey control marks (control stations and spot elevations)  
   vii. Azimuths and bearings  
   viii. Stream gradient  
   ix. Distance values between features  
   x. Geographic coordinate system features and symbols (degrees, minutes, seconds)  
   xi. Elevation of features and symbols  
   xii. Direction of stream flow
b. Highway Map Testing Areas  c. Student-Created Map Design

i. Distances between features  
   ii. Map legends/table/index  
   iii. Map grid system  
   iv. Map symbols  
   v. City/regional inserts

i. Map scales  
   ii. USGS topographic map symbol  
   iii. Distances  
   iv. Azimuths and bearings

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

ROCK HOUND

1. **DESCRIPTION**: Identify rocks and minerals using a rock identification and information chart made by the team and answer questions relating to geologic features from pictures.

**A TEAM OF UP TO**: 2  
**APPROXIMATE TIME**: 50 mins

Rock Hound requires each member of the team to wear goggles. These must be supplied by the team and worn during the event. Only students with goggles will be allowed to participate.

One chart, hand-made, double sided, and a maximum size of 14” x 17”, is allowed, but not required. Charts may be computer printed, but cannot contain any part of the material, subject, illustrations, or pictures. Charts cannot have more than one piece of paper or one piece of tag board. Charts will be reviewed by captains/sponsors, judges, and volunteers prior to the event.

2. **THE COMPETITION**

**Part I: Rock and Mineral Identification**

a. The team has twenty (20) minutes to identify as many rocks and minerals as possible from a group which can include, but is not limited to the following: basalt, bituminous, coal, conglomerate, gneiss, slate, granite, limestone, marble, obsidian, fluorite, pumice, quartzite, sandstone, halite, pyrite, schist [garnet] scoria, shale, calcite, copper, galena, graphite, feldspar [pink], gypsum, hematite, kaolinite, mica [biotite], talc, quartz [several varieties]

b. Each team receives one small dropping bottle with a very limited amount of acid. If excessive amounts are used on rocks and the team runs out, the team receives no additional acid.

c. Items for testing hardness, scratch, etc., will be provided. The amount of acid received will be limited.

**Part II: Geologic Features**

a. Pictures or models relating to geologic features will make up this part of the test.

b. These may include, but not be limited to such things as: talus, slope, geyser, anticline, fault line, tectonic plates, glaciers, volcanoes.

3. **SCORING**

Team with greatest number of correct responses wins  
Tie Breaker: Team with best spelling on Part II
1. **DESCRIPTION:** Identify, use and answer questions about simple machines

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 mins

2. **THE COMPETITION**
   a. Teams move to various stations that contain a picture or example of a simple machine.
   b. Teams identify the machine and answer a question or questions about it, sets it up properly as per instructions and/or uses equipment to measure some variable such as length, force or weight.
   c. The simple machines involved are:
      - Lever
      - Inclined Plane
      - Pulley
      - Screw
      - Wheel
      - Axle Wedge
   d. There is at least one question about each of the six types listed above.
   e. At least two question involve math and use of mechanical advantage, but worded in such a way that only one possible answer will exist for each
   f. Improper calculations reaching a correct answer will not count. [i.e. dividing one wrong number by another wrong number to reach a correct number for the answer will not count]

3. **Scoring**
   Team with the highest score is the winner
   Tie Breaker: The highest score in the section relating to pulleys
STARRY, STARRY NIGHT

1. **DESCRIPTION**: Identify celestial objects and answer questions about astronomical facts and concepts

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 30 mins

2. **THE COMPETITION**
   Penlights are provided for Part I. Late arrivals may not participate in Part I of this event.

   **Part I: Portable Planetarium**
   a. A team identifies the following in a portable planetarium:
      - at least 5 constellations;
      - at least 5 stars;
      - at least 3 planets;
      - at least 3 phases of the moon;
      - [perhaps] constellations of the Orion sky;
      - constellations of the Ursa Major sky;
      - constellations of the Cassiopeia sky;
      - constellations of the Summer Triangle sky.

   **Part II: Written Questions**
   a. Distinguish between rotation and revolution
   b. Demonstrate knowledge about units of time [day month year] and their astronomical bases.
   c. Arrange a group of bodies according to relative sizes from largest to smallest
   d. Arrange a group of objects according to their distances from either the sun or earth
   e. Demonstrate knowledge about the celestial sphere and the following: zenith horizon, four directions, ecliptic, celestial meridian, north celestial pole
   f. Demonstrate knowledge about the members of the solar system
   g. Team turns in one [1] answer sheet with only one [1] answer per question.
   h. Teams may be shown photographs, diagrams, films, slides, or planetarium simulations of star fields and asked to identify indicated stars and constellations

3. **SCORING**
   Team with the most correct answers will be the winner.

   Tie Breaker: Team scoring highest in the written part of the event
TREE IDENTIFICATION

1. **DESCRIPTION:** This event will test student knowledge of Ohio trees

   **A TEAM OF UP TO:** 2  **APPROXIMATE TIME:** 50 min

2. **EVENT PARAMETERS:**
   Each team may bring two 8.5” x 11: two-sided pages of information in any form from any source (notes, tree lists, etc) and no more than two commercially published field guides.

3. **THE COMPETITION**
   a. All questions will be restricted to those identified as common by the Ohio Department of Natural Resources (http://forestry.ohiodnr.gov/trees).
   
   b. This event may be held either indoors or outside on campus or both. Specimens (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 correlated questions.
   
   c. Leaf specimens used for identification may be live, preserved, or color photographs depending on availability and may be accompanied by twigs, cones, seeds, or other parts of the tree. Live or preserved compound leaves should be intact. For each specimen, students will be asked correlated questions that pertain to the trees 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**
   Team with the highest number of correct answers will be the winners. Selected questions may be used as tie breakers.
WATER QUALITY

1. **DESCRIPTION**: This event will focus on evaluating aquatic environments.

   **A TEAM OF UP TO**: 2  
   **APPROXIMATE TIME**: 50 mins

2. **EVENT PARAMETERS**: Each team may bring only one 8.5”x11” two-sided page of notes that contain information in any form from any source and a non-programmable calculator.

3. **THE COMPETITION**: This event will be composed of three sections of approximately equal point value, all focusing on freshwater systems like streams, rivers, ponds, lakes, and wetlands.

   a. The first section will be a written format using multiple choice, matching, fill in the blank and/or short answers to address questions related to characteristics of freshwater ecosystems, aquatic food webs, life cycles of freshwater organisms, and adaptations to life in fresh water.

   b. The second section will include identification of common aquatic organisms. Students should be able to identify both the adult and immature forms of the aquatic animals and the adult forms of the aquatic plants:

   - Mayfly
   - Damselfly
   - Leech
   - Water strider
   - Cattail
   - Arrowhead
   - Caddisfly
   - Mosquito
   - Zebra mussel
   - Purple loosestrife
   - Pickerel weed
   - Duckweed
   - Snail
   - Dragonfly
   - Back swimmer
   - Water lily
   - Buttonbush
   - Water strider
   - Cattail
   - Purple loosestrife
   - Pickerel weed
   - Water lily
   - Buttonbush
   - Marsh mallow

   c. The third section will involve the analysis and interpretation of data. Students will be provided a scenario and asked to make predictions based on the data provided.

4. **SCORING**: Team with the most questions answered correctly is the winner.
1. **DESCRIPTION**: Identify and provide information about various different items representing evidence that was left behind by some thing.

   **A TEAM OF UP TO**: 2                        **APPROXIMATE TIME**: 50 mins

2. **THE COMPETITION**
   a. Teams move from station to station
   b. Items may include, but are not limited to, such things as footprints, tracks, tire tracks, animal scat, fur, chewed sticks and nuts, horns, antlers, slime trails, remains left from an animal which was devoured, scents, etc.
   c. Teams identify what went by and, perhaps, answer a question about it.
      Examples: Is it the left or right foot, the front or the back? In what direction was it moving? What happened at this site? [bird of prey captured it].
   d. Items are limited to organisms from Ohio.

3. **SCORING**
   One point is awarded for each correct identification and one point for each correct answer. The highest score wins.
   Tie Breaker: Team with the greatest number of identifications spelled correctly
WRIGHT STUFF

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

**A TEAM OF UP TO:** 2

**IMPOUND:** None

**EVENT TIME:** 8 minutes

2. **EVENT PARAMETERS:**
   a. Teams may bring up to 2 monoplanes, any tools, and their flight log.
   b. Event Supervisors will provide all measurement tools and timing devices.

3. **CONSTRUCTION PARAMETERS:**
   a. Airplanes may be constructed from published plans, commercial kits and/or a student’s design. Kits must not contain any pre-glued joints or pre-covered surfaces.
   b. Any materials except Boron filaments may be used in construction of the airplane.
   c. Total mass of the airplane throughout the flight, excluding the rubber motor, must be 7.00 g or more.
   d. The airplane must be a monoplane (one wing) and the horizontally projected wingspan must not exceed 40.0 cm. The maximum wing chord (straight line distance from leading edge of wing to trailing edge, parallel to the fuselage) of the wing must be 10.0 cm or less. The maximum horizontally projected stabilizer span is 20.0 cm. The maximum allowable chord of the stabilizer is 7.0 cm.
   e. The propeller assembly may be built by the participants or purchased pre-assembled. It may include a propeller, a shaft, a hanger, and/or a thrust bearing. The propeller must be a single two-bladed propeller with a maximum diameter of 14.0 cm. Variable-pitch propellers that include mechanisms to actively change the blade diameter or angle must not be used.
   f. A rubber motor not to exceed a mass of 1.50 g, including any attachments such as O-rings, must power the airplanes. It will be massed separately from the airplane. Motors may be lubricated before and/or after check-in.
   g. Participants may use any type of winder, but electricity may not be available.
   h. The airplane(s) must be labeled so that the event supervisor can easily identify to which team it belongs.
   i. Students must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

4. **THE COMPETITION:**
   a. The event will be held indoors in the Adelebert Gym.
   b. Once participants enter the competition area they are not to get any outside assistance, materials, or communications. Only participants may handle aircraft components until the event ends. Teams violating this rule will be ranked below all other teams. Spectators will be in a separate area.
   c. During inspection, each team must present a flight log of recorded data. Data must include 6 or more parameters (3 required and at least 3 additional) for 10 or more test flights prior to the competition. The required parameters are: 1) motor size before windup, 2) number of turns on the motor or torque 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 landing, etc.).
d. At the event supervisor’s discretion:
   i. Multiple official flights may occur simultaneously according to the Event Supervisor’s direction.
   ii. Test flights may occur throughout the contest but must yield to any official flight.
   iii. No test flights will occur in the final half-hour of the event’s last period, except for teams that declare a trim flight during their 8-minute Flight Period.

e. Participants will present their event materials (airplanes, motors, and logs) for inspection immediately prior to their Preflight Period.

f. All motors that meet specifications will be collected at check-in and will be re-issued to the team only for their Preflight Period and 8-minute Flight Period. Time taken during the Preflight Period will impact a team’s final score (see 5.b.). Timers will follow and observe teams as they are winding their motors. Event captains are strongly encouraged to return flight logs after inspection.

g. A team’s Preflight Period ends with their first flight, trim or official, which starts their 8-minute Flight Period or if 9 minutes passes after their motor has been returned, whichever comes first.

h. Any flight beginning within the 8-minute Flight Period will be permitted to fly to completion. Participants may make adjustments/repairs/trim flights during their official 8-minute Flight Period. Before their launches, participants must indicate to the Timers whether a flight is official or a trim flight. A flight is considered official if a team fails to notify a Timer(s) of the flight’s status. Teams must not be given extra time to recover or repair their airplanes.

i. Teams may make up to a total of 2 official flights using 1 or 2 airplanes.

j. Time aloft for each flight starts when the airplane leaves the participant’s hand and stops when any part of the airplane touches the floor, the lifting surfaces no longer support the weight of the airplane (such as the airplane landing on a girder or basketball hoop) or the supervisors otherwise determine the flight to be over.

k. Event captains are strongly encouraged to utilize three (3) timers on all flights. The median flight time in seconds to the precision of the device used is the official time aloft.

l. Participants must not steer the airplane during flight.

m. In the unlikely event of a collision with another airplane, a team may elect a re-flight. The decision to re-fly may be made after the airplane lands. Timers are allowed to delay a launch to avoid a possible collision. The 8-minute Flight Period does not apply to such a flight.

n. The event captain will verify with the team the data being recorded on their scoresheet.
5. **SCORING:**
   a. The base score is the Team's longest single official flight time. Ties will be broken by the longest non-scored official flight time.
   b. Teams with incomplete flight logs will have 10% of their flight time deducted from each flight.
   c. Teams without flight logs will have 30% of their flight time deducted from each flight.
   d. Teams that violate a rule under "CONSTRUCTION" or "THE COMPETITION" that does not have a specific penalty will be ranked after all teams that do not violate those rules.

**Recommended Resources:** The Science Olympiad Store (store.soinc.org) carries the Wright Stuff CD and Wright Stuff Video; other resources are on the event page at soinc.org.

https://quizlet.com/subject/wright-stuff-quizlet/
https://www.youtube.com/watch?v=bfizVebRCYQ
https://www.youtube.com/watch?v=7NgylXyepB0
WRITE IT, DO IT

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

**MUST HAVE A TEAM OF:** 2  
**APPROXIMATE TIME:** 50 mins

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, straws, push pins, Styrofoam, popsicle sticks, Tinker Toys, Legos, Lincoln Logs, etc., etc., etc.
   b. A student has twenty-five (25) minutes to write a description of the object and how to build it. 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. All abbreviations (not symbols) must be defined either at the beginning or when the abbreviation is first used.
   c. The event Captain will pass the description to the remaining member of the team in another room who will take the written description and attempt to build the original object in twenty (20) minutes).

3. **SCORING**
   a. The team that builds the object nearest 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 are 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 such as unlabeled abbreviations or improper use of symbols or codes.