



*Exploring the World of Science*

# **SCIENCE OLYMPIAD SUMMER INSTITUTE**

## **DIVISION C DRAFT RULES**

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### **HILTON CONFERENCE CENTER TAPATIO CLIFFS**

### **PHOENIX, AZ - JULY 17-21, 2006**

**ASTRONOMY, Division C** (Revised 7/7/06)

**DESCRIPTION:** Students will demonstrate an understanding of the basic concepts of mathematics and astrophysics relating to **variable stars**.

**A TEAM OF UP TO: 2**

**APPROXIMATE TIME:** 50 minutes

**THE COMPETITION:** Students will provide a scientific calculator. All resources are permitted, including laptop computers and programmable calculators.

Content areas may include H-R diagrams, spectra, light curves, motions, distance equations and relationships, stellar magnitudes and classification, multi-wavelength images, charts, graphs, and animations. Participants will be asked to complete activities which may include the following processes:

1. Use all available information to determine answers relating to **pulsating and cataclysmic variable stars**, including Cepheids, **Long Period Variables**, RR Lyrae variables, **novae**, **dwarf novae**, **recurrent novae**, **T Tauri**, Type Ia & Type II supernovae, and **RV Tauri**.
2. Use all available information, including Kepler's laws, to determine answers relating to the following topics: orbital motions of globular clusters and binaries; and cosmological distance equations; rotation, and circular motion to answer questions about orbital motions and distances of Cepheids, RR Lyrae variable stars, type Ia supernovae, and planetary nebulae. **\*\*\* (N)**
3. Students should be able to identify and be knowledgeable about **light curves**, spectra, **periodicity**, **apparent and absolute magnitudes**, **maxima**, **minima**, type of variability, evolutionary stage; **phase diagrams** and **O-C diagrams** **\*\*\* (N)**;
4. Students will be asked to identify, be knowledgeable about, and answer questions relating to the three content areas outlined above for the following Deep Sky Objects (DSOs): Mira, 47 Tucanae, SS Cygni, Cas A, Tycho's Remnant, Algol beta Persci, Delta Cephei, GK Per (Nova Persei 1901), SN 1987A, DEM L316, Omega Centauri, Z Cam, R Scuti, Mz 3 (Ant Nebula), Orion Nebula (M42), Nova Aquilae, Betelgeuse
5. **Competition may include one or more stations. Examples include placing images on an H-R diagram; placing images; light curves, and H-R diagrams of DSOs in sequence from formation to end product; using software to determine the period of a variable star** **\*\*\* (N)**; **using spectra, light curves, and O-C diagrams to predict maxima** **\*\*\* (N)**.  
**\*\*\* (N) content appropriate for States and National; may be excluded for Regionals**

**RESOURCES:**

Science Olympiad Astronomy CD: <http://www.soinc.org>

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

[http://chandra.harvard.edu/edu/formal/variable\\_stars/](http://chandra.harvard.edu/edu/formal/variable_stars/)

[http://chandra.harvard.edu/edu/formal/stellar\\_ev/](http://chandra.harvard.edu/edu/formal/stellar_ev/)

[http://www.tufts.edu/as/wright\\_center/fellows/sci\\_olympiad/sci\\_olympiad\\_astro.html](http://www.tufts.edu/as/wright_center/fellows/sci_olympiad/sci_olympiad_astro.html)

<http://chandra.harvard.edu/photo/index.html>

<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

> ONLY USE THESE RESOURCES

**SCORING:** All questions will have been assigned a predetermined number of points. The highest score wins. Selected questions having differentiated weights will be used as tie breakers.

**NATIONAL SCIENCE EDUCATION STANDARDS:** Science as Inquiry, Content Standard A: Use Technology and Mathematics to Improve Investigations and Communications; Formulate and Revise Scientific Explanation and Models using Logic and Evidence; Earth and Space Science, Content Standard D: The Origin and Evolution of the Universe (Grades 9-12).

## BOOMILEVER

1. **DESCRIPTION:** The objective of this event is to design and build the lightest boomilever ~~capable of supporting a given load.~~ The boomilever is a cantilevered wooden structure which, ~~will be~~ **when** attached to a vertical Testing Wall at one end, ~~and supporting a~~ **will support the greatest** load at the distal end. Teams should maintain and submit a log containing information about the structures they have built that can be used to improve future designs. Contestants must bring and wear approved Safety Spectacles with Side Shields. See: <http://www.soinc.org/general/protection/>

**A TEAM OF UP TO:** 2

**IMPOUND:** Yes (1 Boomilever & Log)

**MAXIMUM TIME:** 10 minutes

2. **Materials:**

- The Boomilever is to be a single structure constructed only of wood and bonded by glue. No other materials shall be used. **Particleboard, plywood, beaverboard, other composite wood products, bamboo or paper may not be used except for the Attachment Base.**
- The **entire** Boomilever (**except for the Attachment Base**), including gussets, must be constructed of pieces of wood no larger than ¼ inch high and ¼-in wide in cross-section. If dowels are used, they may not have a diameter greater than ¼ inch. **There is no limit on the length of individual wood pieces used in the construction.**
- The Boomilever may have an Attachment Base for attaching it to the Testing Wall. The Attachment Base must be in one or two parts made from any type and size of wood or wood product(s). The entire Attachment Base may not exceed 30 cm x 20 cm x ½ inch thick, must be permanently attached to the Boomilever and is included in the mass of the Boomilever. When mounted to the Testing Wall, no part of the Attachment Base may extend further than 1/2 inch from the wall. All pieces of the Boomilever that extend greater than 1/2 inch from the wall must meet the ¼ inch x ¼ inch requirement.
- Any type of glue may be used.

3. **Construction:**

- All construction must be completed prior to impounding the Boomilever **at the tournament.**
- Any Boomilever design that meets the specifications below may be constructed.** Sound engineering and construction practices such as trusses, mitered joints/corners, gussets, and lamination (layers of wood glued together) are encouraged.
- Unlimited lamination by the contestants is allowed **however, commercially laminated wood (except for the Attachment Base) is not.** Wood laminations may be any size provided the individual pieces used to make them comply with paragraph 1)b above.
- The Boomilever must meet the following parameters
  - It must be designed so that it can be attached to a vertical-Testing Wall, made from ¾ inch thick plywood or other suitable material. The wall will be approximately 45 cm wide and 30 cm high with two 1/4 inch diameter holes spaced 20.0 cm apart on center horizontally, 5 cm below the top of the wall.
  - The Boomilever must be attached to the Testing Wall using one or two ¼ inch diameter x 2 inch long bolts with washers no larger than 3/4 inch in diameter and wing nuts.
  - The Boomilever must accommodate a Loading Block 5.0 cm x 5.0 cm square x 2.0 cm high with a 1/4 inch diameter hole in the center. A 1/4 inch eyebolt will be secured in the hole with a washer and nut on top and an s-hook for suspending a plastic bucket (approximately 5-gallons/30 cm diameter) from the eyebolt.
  - When placed on the Boomilever, the center of the hole in the Loading Block must be a minimum of 40 cm from the Testing Wall.
  - No part of the Boomilever may touch the Testing Wall further than 20.0 cm below the center of the attachment holes.
  - Before it is impounded the Boomilever must be marked in such a way that the event supervisor can easily identify to which team it belongs.

4. **Testing:**

- a) All Boomilevers and logs must be impounded before the start of the event and will be released from impound when the team has finished competing. No alterations to the Boomilever will be allowed once it has been impounded. Appeals by teams will not be processed after they remove their device from impound unless it has been released by the appeals committee.
- b) Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials or communication until they are finished competing. Only contestants and judges will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.
- c) All Boomilevers will be assessed prior to testing to determine if they meet the specifications under Materials and Construction above.
- d) The judges will provide all equipment used for testing except for the contestant's eye protection. This includes the Testing Wall, Loading Block, eyebolt with washer and nut, bolts with wing nuts and washers, plastic bucket and sand.
- e) Teams must supply their own eye protection. Those that do not bring and wear proper eye protection will not be allowed to test their Boomilever.
- f) Judges must verify prior to loading each Boomilever that the combined mass they provide to the team is at least 15 kg.
- g) The contestants will attach the Boomilever to the Testing Wall using the bolts, nuts and washers provided by the judges. The bolts may be inserted from either side of the wall and Boomilever.
- h) The contestants will place the Loading Block at the load point of the Boomilever and insert the eyebolt through Loading Block and secure it with a washer and wing nut on top of the Loading Block. They will use the s-hook to suspend the bucket from the eyebolt.
- i) **The students will be given 10 minutes to load sand into the bucket. Loading must stop when failure of the Boomilever occurs, when the maximum load of 15 kg is supported or when the time expires. Failure is defined as the inability of the Boomilever to support additional load. Sand added after any of these conditions occurs will be removed by the event supervisor. The Load Supported at that time will be used to calculate the Structural Efficiency.** The mass of the Loading Block, eyebolt, washer, wing nut, bucket, and sand are included in the Load Supported

5. **SCORING:**

- a) The Score will be determined by the Structural Efficiency equation:  

$$\text{Structural Efficiency} = \text{Load Supported (grams)} / \text{Mass of Boomilever (grams)}$$
- b) Boomilevers that hold more than 15 kg will be scored using 15 kg as the Load Supported.
- c) Boomilevers will be scored in 3 tiers. Boomilevers in the first 2 tiers will be ranked by their Structural Efficiency.
  - i) Boomilevers that meet all specifications under Materials and Construction will be ranked in the first tier.
  - ii) Boomilevers that DO NOT meet all of the specifications under Materials and Construction but can be tested will be ranked in the second tier.
  - iii) Boomilevers that cannot be tested for any reason (e.g., cannot accommodate the Loading Block or team does not have proper eye protection) will be ranked in the last tier by the Boomilever's lighter mass.
- d) Ties will be broken in favor of the team with the lightest tower. Remaining ties will be broken using the team's log.

See: <http://www.soinc.org/events/boomilever/>

## CHEMISTRY LAB

### DESCRIPTION:

Teams will answer a series of questions or complete a task involving the science processes of chemistry focused in the areas of **nuclear chemistry and gas laws**. No reference materials are allowed. Do not bring a calculator! If needed, calculators will be supplied.

### SAFETY REQUIREMENTS:

Students must wear the following or they will not be allowed to participate: close-toed shoes, OSHA approved chemical splash goggles with indirect vents, pants or skirts that cover the legs to the ankles and a lab coat or apron that reaches below the knees. 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.

### TEAM OF UP TO: 2

APPROXIMATE TIME: 50 minutes

### THE COMPETITION:

The competition will consist of a series of stations that include activities similar to those in first year high school courses. These stations could include hands-on activities, questions about each topic, interpretation of experimental data (graphs, diagrams, etc.), and/or observation of an experiment set up and running. Supervisors are encouraged to use computer or calculator sensors/probes wherever possible or provide students with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in a tabular and/or graphic format and students will be expected to interpret the data. Students should be aware that nomenclature, formula writing, and stoichiometry are essential tools of chemistry and may be included in the event at any time. Stoichiometry includes, for example, such abilities as mole conversions and percentage yield. For purposes of nomenclature and formula writing, students are expected to know the symbols and charges for the following ions by memory: nitrate, carbonate, phosphate, acetate, sulfate, ammonium, bicarbonate, and hydroxide. Students should know how to use the "ite" form of an ion, which is one less oxygen than the "ate" form. Students should be able to use the periodic table to obtain the charge for monatomic ions (e.g.,  $\text{Na}^+$ ,  $\text{S}^{2-}$ , etc.)

1. The event will cover theory and application of the areas below. The following items will be provided by the supervisor if needed: (a) periodic table (b) calculator (c) any constants needed (d) any polyatomic ions not included in the group to be memorized.
2. The lab portion may be run in microscale.
3. Cleanup should occur after all materials have been returned or a penalty may be given.
4. **Students may be expected to prepare data tables and/or construct graphs of the data. Completeness, accuracy and quality of data tables and graphs will be taken into account.**
5. All measurements must be recorded with correct significant figures and units. All calculations must also include correct significant figures and units. Stations might include the following topics or activities:

**Nuclear Chemistry:** Students will complete experimental tasks and answer questions related to nuclear reactions, non-electric uses of nuclear power such as food irradiation and nuclear medicine, use a dose chart to calculate exposure, and half-life. Students may be provided with a Geiger-Mueller tube and counter or radiation monitor, radioactive sources, or shielding materials. Students may be expected to complete labs/activities such as:

- Simulate the transformation of a radioactive isotope over time, graph data, and relate to radioactive decay and half life
- Use a Geiger counter or radiation monitor to:
  - detect emissions from naturally occurring radioactive substances
  - measure radiation emitted by a source as a function of distance
  - study the effectiveness of shielding by paper, wood, aluminum, etc.
- Investigate detection, shielding and storage considerations needed when handling radioactive sources.

**Gas Laws:** Students will complete experimental tasks and answer questions related to the physical properties of gases, effect of greenhouse gases and ozone depletion on our climate, behavior of gases described by the following: Avogadro's law, Boyle's Law, Charles' Law, Dalton's law, Gay-Lussac's law, Graham's Law, and the ideal gas law. Students may be expected to complete labs/activities such as:

- Determine the:
  - density of a gas
  - partial pressure of a gas
  - molar mass of a gas
  - relative rates of diffusion
- Examine the relationship between:
  - Pressure and volume
  - Pressure and temperature
  - Temperature and volume

**SCORING: Nuclear Chemistry: 50% and Gases: 50%.** Points will be awarded for correct answers and/or proper technique. Time may be limited at each station, but time will not be used as a tiebreaker or for scoring. All ties will be broken by selected questions chosen by the supervisor. These questions may or may not be identified to the students.

## CIRCUIT LAB

**DESCRIPTION:** Students will compete in activities involving knowledge of direct current (DC) Electrical Circuits. The event may include hand-on experimentation and/or problem solving. Students may use non-programmable calculators.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 minutes

### THE COMPETITION:

The competition will consist of tasks and questions related to DC electrical circuits. The event supervisor may provide some mathematical relationships but the students are expected to know:

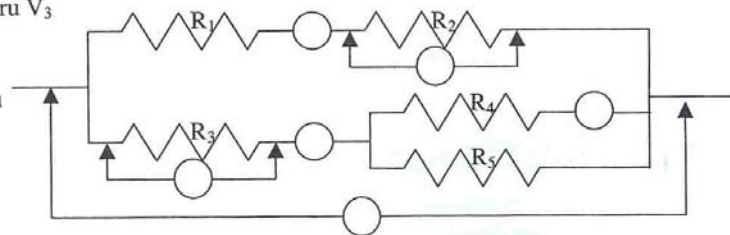
- 1) The basic mathematical statements, definitions, concepts and principles involved.
- 2) Simple DC circuits theory including voltage, current, power, conversion of electric power to heat, RC time constants (charging and/or discharging of a capacitor through a resistor by a constant voltage source), conventional current and/or electron current, energy stored in a capacitor, Ohm's Law, electrical SI units (Coulomb, ampere, Volt, Ohm, Farad, Joule, Watt, second;
- 3) The characteristics of DC circuit components such as Electromotive Force Devices (DC power supplies, batteries and DC generators), resistance, internal resistance of EMFs, capacitors, diodes, solar cells, and DC motors;
- 4) The theory, use, and limitations of DC measurement equipment such as Galvanometers, Voltmeters (including limiting resistor calculations), Ammeters (including shunt resistor calculations), and Multimeters.

Supervisors are encouraged to use computer and/or calculator sensors/probes wherever possible or provide students with data sets collected by such sensor/probes following demonstration of the data collection. If used, data will be presented in a tabular and/or graphic format and students will be expected to interpret the data.

### **Examples of Circuit Lab Stations:**

A circuit consisting of resistors in parallel and/or series and one or more batteries in parallel and/or series will be assembled. Students will be asked to determine electric potential difference between specified locations within the circuit, currents (including direction of electron or conventional flow), resistance, and power dissipation in different parts of the circuit. The circuits may also include diodes, solar cells and DC power supplies. The internal resistance of the batteries may be one of the values to be determined. Students are expected to know basic electrical definitions, equations and how to use electrical meters and multimeters.

- Given  $A_1$  thru  $A_3$  &  $V_1$  thru  $V_3$   
Find  $R_1$  thru  $R_5$
- Given  $R_1$  thru  $R_5$ , Find  $A_1$   
thru  $A_3$  &  $V_1$  thru  $V_3$



**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.

## DESIGNER GENES (C)

**DESCRIPTION:** Students will solve problems using their knowledge of **Molecular Genetics, Biotechnology, and Population Genetics.**

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

**EVENT PARAMETERS:** Non-programmable calculators may be used, but no reference materials may be used during the competition. References, training resources are available on the Official Science Olympiad Web Page at <http://www.soinc.org>.

**THE COMPETITION: THE COMPETITION:** This event may be run at stations. Every attempt should be made to avoid over-emphasis on a particular area.

1. **At the various levels, possible areas to be tested may include:**

Regional	State (regional plus these)	National (all topics)
DNA structure & function	Gene therapy	Restriction mapping
DNA fingerprinting	Control and detection of gene expression	Mitochondrial DNA
PCR	Mutations	RFLP
DNA Sequencing	Plasmid selection and isolation	Post- transcriptional modification
DNA Replication		Trinucleotide repeats
Gene expression (transcription and translation)		
Basic Hardy-Weinburg analysis		

**Note:** Regions or States may decide to cover all of the topics so check with your local tournament director for specifics.

2. Process skills may include observations, inferences, predictions, data analysis, and calculations.

### **EXAMPLES:**

- Gel electrophoresis set up and running. Photograph showing results of a gel with the lanes labeled: mother, child, male 1 and male 2.
  - Identify the apparatus or process (gel electrophoresis).
  - According to the results, who is the possible father of the child?
  - Why do the bands of DNA in the photograph end up at different locations within their lanes? (Smaller DNA fragments move through the gel faster)
  - What is the size of fragment 3 in Lane 3?**
- Given a sequence of coding strand DNA,
  - What is the sequence of the corresponding RNA?**
  - Using the genetic code, what would be the sequence of amino acids made from this RNA?**
- Given a DNA sequencing gel, determine the sequence of bases in the sample.
- If the frequency of the recessive allele is 0.2, what is the frequency of the heterozygous individuals in the population

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

## DISEASE DETECTIVES (C)

**DESCRIPTION:** Epidemiology is the scientific study of disease, injury, health, and disability in populations (including "outbreaks") and entails: reasoning skills, such as those used by "disease detectives"; a quantitative view of risks; survey methods to study opinions, behaviors, or other aspects of populations, including school classes; and interdisciplinary links between medicine, statistics, and laboratory sciences. **There will be a focus on environmental causes of public health problems.**

**EVENT PARAMETERS:** Non-programmable calculators are permitted, but not reference materials. References and training resources are available on the CDC website at [www.cdc.gov/excite](http://www.cdc.gov/excite) and the Official Science Olympiad Web Page at <http://www.soinc.org>.

Detective here

**A TEAM OF UP TO:** up to 2

**APPROXIMATE TIME:** 50 minutes

**THE COMPETITION:** This event requires students to apply principles of epidemiology to a published report of a real-life health situation or problem. The competition will require the students to use the scientific and systematic approach to investigating epidemics and other public health problems (e.g., finding and counting cases, comparative reasoning, hypothesis generation, hypothesis testing). Related task and knowledge areas of epidemiology and other biomedical sciences include: Basic definitions of epidemiological terms (e.g., epidemiology, epidemic, outbreak, incidence, rates, public health surveillance); Categories of disease-causing agents (e.g., bacteria, toxins, mechanical forces, behavior); Modes of disease spread (e.g., person-to-person, foodborne, airborne, vectorborne); The triads of elements of analysis of epidemiological data collected to investigate outbreaks and other problems (e.g., time/place/person, and agent/host/environment); Fundamental analysis of epidemiological data (e.g., case-control and cohort analyses); and the basis for taking action to control and prevent the spread of disease. This event should include stations. These could involve collection of data, creating graphic displays of information and interpreting trends and patterns of epidemiologic or environmental data.

**SAMPLE PROBLEMS:** The students will read a report adapted from a newspaper, a scientific publication, or an Internet site (e.g., [www.cnn.com](http://www.cnn.com) (see health) or [www.cdc.gov](http://www.cdc.gov) (see MMWR which is CDC's weekly bulletin called the *Morbidity and Mortality Weekly Report*) on an outbreak or other public health condition in a community or population. It is recommended that students review [www.cdc.gov/excite](http://www.cdc.gov/excite) for excellent sample questions with suggested answers. Students will answer questions relating to determining and describing the epidemiology of the problem and potential interventions or prevention activities. Possible tasks might include:

- Given the scenario of the outbreak or condition, explain why you might consider this an important problem, and give at least three general reasons why you should respond to the problem.
- Briefly describe the initial steps of an investigation to respond to this problem. For example, develop a case definition, determine the data needed for the initial steps, and give some examples of possible sources of such data in a community or study population.
- Construct or interpret relevant charts, graphs, or tables used to describe the problem.
- Calculate measures of disease risk (e.g., incidence rate, odds ratio, or relative risk).
- Develop and specify probable hypotheses to explain the cause/source/spread of the outbreak.
- Describe approaches to testing alternative hypotheses (e.g., case-control, cohort, or other study).
- Apply principles of causation to a public health problem.
- Develop suitable recommendations and/or interventions for controlling the problem; if recommendations already have been made, then evaluate the advantages and disadvantages of the recommendations.

**SCORING:** Depending on the problem, scoring may be based on a combination of answers, including graphs/charts, explanations, analysis, calculations, and closed-ended responses to specific questions. Points should be awarded for both quality and accuracy of answers, the quality of supporting reasoning, and the use of proper scientific methods: each completed graph or table is worth up to five points; open-ended questions that require a paragraph of explanation to report the proper interpretation are worth up to ten points; closed-ended responses are worth up to five points each. **Highest number of points will determine the winner. Selected questions may be used as tiebreakers.**

**THIS EVENT IS SPONSORED BY THE CENTER FOR DISEASE CONTROL (CDC)**

## ECOLOGY (C)

**DESCRIPTION:** Students will answer questions involving content knowledge and process skills in the area of ecology and adaptation by examining different ecosystems.

**A TEAM OF UP TO:** up to 2

**APPROXIMATE TIME:** 50 Minutes

**EVENT PARAMETERS:** Students may bring a non-programmable calculator. No other reference material will be allowed. References and training resources are available on the Official Science Olympiad Web Page at <http://www.soinc.org>.

### **THE COMPETITION:**

1. The event will emphasize these process skills as they apply to ecology: defining variables; analyzing data from graphs and tables; presenting data in graphs and tables; forming hypotheses; making calculations and predictions.
2. All questions should deal with the following ecological principles: Energy flow through food webs and trophic pyramids including quantitative analysis of data; nutrient cycling, community interactions; population dynamics including density dependent/independent limiting factors, carrying capacity, doubling time, exponential/logistical growth and how to calculate population growth; life history strategies (age structure, survival curves, life tables); extinction, selection and migration; human impact upon ecosystems (global warming, invasive species, acid rain, erosion, pollution); If stations are used, students must spend the same amount of time at each station.
3. **Approximately 40% (regional), 50% (state), 60% (national) of the questions** should specifically address ecological principles as they apply to two ecosystems for 2007: **Marine (including estuaries) and Forests of North America**. In each subsequent year, one ecosystem will remain and one replaced by the next ecosystem on the list: freshwater lakes and streams, marine (including estuaries), forests of all kinds including rain forests, deserts, grasslands, taiga, tundra.

### **SAMPLE QUESTIONS**

1. Given a complex food web, create a trophic pyramid and determine the amount of energy in each level when given a quantity of energy entering the producer level.
2. Students are given a graph depicting the changes in two interacting populations of different species in a habitat. Predict which population is the predator and which is the prey. Give reasons for your choices.
3. Determine the population growth rate for an area given  $r$  (rate of increase) and  $N$  (number of individuals).
4. Compare a coniferous forest with a tropical rain forest. What kinds of adaptations may be common in both environments? How are the organisms in each environment adapted for the rates of nutrient recycling that you would expect to find?
5. Students are given three age structures and asked to determine which population has the highest birth rate, death rate, doubling time, and mean age.
6. An aquarium that contains algae and snails is compared with an aquarium that only contains algae. Students are asked to graph and then explain their prediction of oxygen and carbon dioxide levels in each of the aquaria over a twenty-four hour period if light is provided for only 12 of the hours.
7. Why is the burning of natural gas ( $\text{CH}_4$ ) less of a problem for acid rain than other fossil fuels?

**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.

## ENTOMOLOGY (C)

**DESCRIPTION:** In this event, students will be asked to identify insects and selected immature specimens as to their order and family from 29 common orders of insects. Because taxonomic schemes may vary from source to source, only the Science Olympiad Official Insect List will be used for all competitions.

**NUMBER OF PARTICIPANTS:** Up to 2

**APPROXIMATE TIME:** 50 minutes

**EVENT PARAMETERS:** Teams may bring 1) one identification guide (**suggested resource-Audubon Field Guild**), 2) student developed notes and handwritten or printed resources that can be hole punched and attached to the rings of 1" binder that fit in an area no larger than 12" x 12" x 1.5" and 3) pre-printed stick-on labels (order and family only). Students may not use any electronic devices. The Official Insect List which is available along with references, teaching resources, and suggested regional/state competition emphasis on the Official Science Olympiad website at <http://www.soinc.org>.

### **THE COMPETITION:**

1. Each team will be given an answer sheet on which they will record answers.
2. Insect specimens, or images (nymph or larva for selected orders and families) will be exhibited so that students will be able to see pertinent features with the unaided eye or a hand lens. **Dissecting microscopes will be provided as needed.**
3. For **any individual specimen**, questions may also be asked concerning the economic or health impact of the specimen upon the human race.
4. **Topics may include structure and function of internal and external anatomy, ecology, behavior, and history.**
5. Process skills may include observations, inferences, data and diagram analysis.
6. One of the stations may involve students using or formulating a simple dichotomous key **to identify insects.**

### **SCORING:**

The team with the highest number of correct answers will determine the winner. Selected questions may be used as tiebreakers.

**Division B/C – Common Orders-Specimens will be come from this Official list of 29 insect orders:**

- |  |   |
|--|---|
| A. Protura (proturans)                           | P. Anoplura (sucking lice)              |
| B. Collembola (springtails)                      | Q. Thysanoptera (thrips)                |
| C. Diplura (diplurans)                           | R. Hemiptera (true bugs)                |
| D. Thysanura (silverfish)                        | S. Homoptera (aphids, cicadas, hoppers) |
| E. Ephemeroptera (mayflies)                      | T. Megaloptera (dobsonflies)            |
| F. Odonata (dragonflies, damselflies)            | U. Neuroptera (lacewings, antlions)     |
| G. Blattodea (cockroaches)                       | V. Coleoptera (beetles)                 |
| H. Mantodea (mantids)                            | W. Strepsiptera (Twisted-Wing Parasite) |
| I. Isoptera (termites)                           | X. Mecoptera (scorpionflies)            |
| J. Grylloblattodea (Ice Insect)                  | Y. Siphonaptera (fleas)                 |
| K. Dermaptera (earwigs)                          | Z. Diptera (flies)                      |
| L. Plecoptera (stoneflies)                       | AA. Trichoptera (caddisflies)           |
| M. Orthoptera (crickets, grasshoppers, katydids) | BB. Lepidoptera (butterflies, moths)    |
| N. Phasmatodea (walking sticks)                  | CC. Hymenoptera (ants, bees, wasps)     |
| O. Mallophaga (chewing lice)                     |   |

## 2007 Entomology – Official Insect List

Division C-Orders and Families Specimens will be come from this Official list of 29 insect orders and 100 families. Orders Or Families Marked By An “\*” Require That The Contestant Be Able To Recognize Larvae Or Nymph Forms. Letters refer to orders - numbers refer to families: (The taxonomic scheme is based upon the Audubon Insect and Spider Field Guide)

- |  |   |   |
|--|---|---|
| <p>A. Protura-telsontails, <b>proturans</b><br/>         B. Collembola-springtails, snow fleas<br/>         C. Diplura-diplurans<br/>         D. Thysanura-bristletails, silverfish<br/>         E. Ephemeroptera-mayflies<br/>         *F. Odonata-dragon/damselflies<br/>             1. Aeshnidae-darners, <b>dragonflies</b><br/>             2. Gomphidae-<b>clubtails</b><br/>             3. Libellulidae-skimmers, <b>dragonflies</b><br/>             4. <b>Lestidae-Spreadwing</b><br/>             5. Coenagrionidae-narrow winged<br/>         G. Blattodea-roaches<br/>         H. Mantodea-mantids<br/>         I. Isoptera-termites<br/>         J. Grylloblattodea-Ice insects<br/>         K. Dermaptera-earwigs<br/>         L. Plecoptera-stoneflies<br/>         M. Orthoptera-grasshoppers &amp; crickets<br/>             6. Tetrigidae- pygmy grasshopper<br/>             7. Acrididae-<b>short-horned grasshoppers</b><br/>             8. Tettigoniidae-katyids<br/>             9. Gryllacrididae- camel crickets<br/>             10. Gryllidae crickets/tree crickets<br/>             11. Gryllotalpidae-mole crickets<br/>         N. Phasmatodea-walking sticks<br/>         O. Mallophaga-chewing lice<br/>         P. Anoplura-sucking lice<br/>         Q. Hemiptera-true bugs<br/>             12. Corixidae-<b>water boatman</b><br/>             13. Notonectidae-backswimmers<br/>             14. Belostomatidae-giant water bugs<br/>             15. Nepidae-water scorpions<br/>             16. Gelastocoridae-toad bugs<br/>             17. Gerridae-<b>water striders</b><br/>             18. Cimicidae-<b>bed bugs</b><br/>             19. Miridae-<b>leaf bugs</b><br/>             20. Reduviidae-assassin bugs<br/>             21. Phymatidae-<b>ambush bugs</b><br/>             22. Tingidae-<b>lace bugs</b><br/>             23. Lygaeidae-<b>seed bugs</b><br/>             24. Coreidae-<b>leaf-footed bugs</b><br/>             25. Pentatomidae-Stink bugs<br/>         R. Homoptera-cicadas, aphids, hoppers, etc.<br/>             26. Cicadidae-cicadas<br/>             27. Membracidae-<b>tree hoppers</b><br/>             28. Cercopidae-<b>frohoppers, spittle bugs</b><br/>             29. Cicadellidae-<b>leafhoppers</b><br/>             30. Fulgoridae-fulgorid planthoppers<br/>             31. Aphididae-aphids<br/>             32. Dactylopiidae-scale (twig or leaf)<br/>         S. Thysanoptera-thrips</p> | <p>T. Megaloptera- dobsonflies<br/>         U. Neuroptera- (lacewings, antlions)<br/>             33. Chrysopidae-<b>green lacewigs</b><br/>             *34. Myrmeleontidae-<b>antlions</b><br/>         V. Coleoptera-beetles<br/>             35. Cicindelidae-<b>tiger beetles</b><br/>             36. Carabidae-<b>ground beetles</b><br/>             37. Dytiscidae-<b>predaceous diving beetles</b><br/>             38. Gyrinidae-<b>whirligig beetles</b><br/>             39. Hydrophilidae-<b>water scavenger beetles</b><br/>             40. Histeridae-<b>hister beetles</b><br/>             41. Staphylinidae-rove beetles<br/>             42. Silphidae-<b>carion beetles</b><br/>             43. Lucanidae-<b>stag beetles</b><br/>             44. Passalidae-<b>bess beetles</b><br/>             45. Scarabaeidae-<b>dung beetles,</b><br/>             46. Buprestidae-<b>metallic wood-boring beetles</b><br/>             47. Elateridae-<b>click beetles, wireworms</b><br/>             48. Lamphyridae-<b>fire flies</b><br/>             49. Cantharidae-<b>soldier beetles</b><br/>             50. Lycidae-<b>net-winged beetles</b><br/>             51. Cleridae-<b>checkered beetles</b><br/>             52. Coccinellidae-<b>lady-bird beetles (ladybugs)</b><br/>             *53. Tenebrionidae-<b>darkling beetles</b><br/>             54. Meloidae-<b>blister beetles</b><br/>             *55. Cerambycidae-<b>long-horned beetles</b><br/>             56. Chrysomelidae-<b>leaf beetles</b><br/>             57. Curculionidae-<b>weevils</b><br/>         W. Strepsiptera Twisted-Wing Parasite<br/>         X. Mecoptera-scorpionflies<br/>             58. Boreidae- snow scorpionflies<br/>             59. Panorpidae- common scorpionflies<br/>         Y. Siphonaptera-fleas<br/>         Z. Diptera-true flies<br/>             60. Tipulidae-<b>crane flies</b><br/>             *61. Culicidae-<b>mosquitoes</b><br/>             62. Chironomidae-<b>midges</b><br/>             63. Simuliidae- black flies<br/>             64. Stratiomyidae-<b>soldier flies</b><br/>             65. Tabanidae-<b>horse flies</b><br/>             66. Asilidae-<b>robber flies</b><br/>             67. Bombyliidae-<b>bee flies</b><br/>             68. Syrphidae-<b>flower flies</b><br/>             69. Tephritidae-<b>fruit flies, huskfly</b><br/>             70. Drosophilidae-<b>pomace flies</b><br/>             71. Muscidae-<b>house flies</b><br/>             72. Hippoboscidae-<b>louse flies</b><br/>             *73. Calliphoridae- <b>blow flies</b></p> | <p>74. Tachinidae-<b>tachinid flies</b><br/>         *AA. Trichoptera-caddisflies<br/>         BB. Lepidoptera-moths and butterflies<br/>             75. Sesiidae-clear winged moths<br/>             76. Tortricidae- Tortricid moths<br/>             77. Hesperidae-skipper<br/>             *78. Papilionidae-<b>swallowtails</b><br/>             79. Pieridae-whites, sulfurs<br/>             80. Lycaenidae- <b>hairstreaks/blues</b><br/>             81. Nymphalidae-<b>brush-footed butterfly</b><br/>             82. Satyridae-Satyrs, nymphs and arctics<br/>             83. Danaidae-milkweed butterflies<br/>             84. Pyralidae-pyralid moths<br/>             *85. Saturniidae-<b>Giant Silkworm moths</b><br/>             *86. Sphingidae-<b>sphinx moths, hornworms</b><br/>             87. Arctiidae-<b>tiger moths, wooly worms</b><br/>             88. Lymantriidae-<b>tussock moths</b><br/>             89. Noctuidae-<b>noctuid moths</b><br/>         CC. Hymenoptera-bees/ants/wasps...<br/>             90. Tenthredinidae- common sawflies<br/>             91. Siricidae-horntails<br/>             92. Ichneumonidae-<b>ichneumons</b><br/>             93. Cynipidae- gall wasps<br/>             94. Mutillidae- velvet-ants<br/>             95. Formicidae-ants<br/>             96. Vespidae-<b>paper wasps</b><br/>             97. Colletidae- <b>Plaster bees</b><br/>             98. Halictidae- <b>Alkali bees</b><br/>             99. Megachilidae- <b>leaf cutter bees</b><br/>             100. Apidae-<b>bees</b></p> |
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### EXPERIMENTAL DESIGN

**DESCRIPTION:** This event will determine a team's ability to design, conduct, and report the findings of an experiment actually conducted on site.

**EVENT PARAMETERS:** Students must bring safety goggles and a writing instrument(s). Students may also bring a timepiece, a ruler, and a non-programmable calculator.

**THE COMPETITION:**                    **A TEAM OF UP TO:** 3                    **APPROXIMATE TIME:** 50 minutes

1. Supervisors will provide teams with all the 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. Both the card and the container could 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.
2. The supervisor will 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).
3. The students will be given an outline (patterned after the scoring rubrics) to follow when recording/reporting their experiment.
4. When the teams are finished, all materials will be returned to the event supervisor along with all written materials. The content of the report must be clearly stated and legible.

**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

1. Statement of Problem: Experimental Question (2 Points)
2. Hypothesis: Including prior knowledge that contributed to hypothesis (4 Points)
3. Variables:
  - Independent Variable: Factor being manipulated (3 Points)
  - Dependent Variable: Factor being measured which responds (3 Points)
  - Constants: (Controlled Variables) Factors that are purposefully kept the same (4 Points)
4. Experimental Control: (Standard of Comparison) (2 Points)
5. Materials (3 Points)
6. Procedure: Including Diagrams (6 Points)
7. Qualitative Observations During Experiment & Summary of Results: (4 Points)
8. Data Table: (Including Use of Significant Figures Division C) (6 Points)
9. Graph(s): (6 Points)
10. Statistics: Including the Average and other relevant statistic such as median, mode, range, or drawn in line of best-fit (2 Points) + Including a measure of central tendency (mean), a measure of variation (range or standard deviation), regression analysis (line of best-fit), and any other relevant statistics (4 Points)
11. Analysis of Results: Interpretation (4 Points) Division B
12. Possible Experimental Errors including identified human errors (3 Points)
13. Conclusion: Include why your results did or did not support the hypothesis: (4 Points)
14. Recommendations for Further Experimentation Based on Your Data & Practical Applications: (4 Points)

**HINTS:** 1. 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. 2. Experiments should consist of repeated trials. 3. The variables should be operationally defined. 4. Experiments should be simple and have only one independent and one dependent variable.

**Recommended Reference: Science Olympiad Experimental Design Guide-see Store at [www.soinc.org](http://www.soinc.org).**

## FERMI QUESTIONS

### DESCRIPTION:

A "Fermi Question" is a science related question that seeks a fast, rough estimate of a quantity, which is either difficult or impossible to measure directly. For example, the question "How many drops of water are there in Lake Erie?" requires an estimate of the volume of a drop, the volume of Lake Erie from its approximate dimensions and conversion of units to yield an answer. The answers should be an estimate within an order of magnitude recorded in power(s) of ten

**EVENT PARAMETERS:** Calculators, computers, slide rules, reference sheets, etc., are **NOT** allowed. Bring pencils. Teams are allowed to finish before the allotted time: they should hand in their answer sheet, have the time recorded by the event supervisor, and exit the room quietly.

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

### THE COMPETITION:

1. Each team will have about 50 minutes to answer as many questions as possible.
2. All Teams will be quizzed together and will be given no feedback on point counting during the question.
3. One teammate will be designated to serve as the team captain and will indicate on the score sheet the team's answers.
4. All answers are to be written to the nearest integral power of ten (exponent). For example, if the number is  $1.4 \times 10^6$ , you record 6 as your answer. If it is  $8.6 \times 10^3$ , you record 4. Responses recorded as  $8.6 \times 10^3$  on the answer sheet will be marked as incorrect.

<b>SCORING:</b>	<b><u>If the response is:</u></b>	<b><u>It earns:</u></b>
	equal to the accepted value	5 points
	$\pm 1$ of the accepted value	3 points
	$\pm 2$ of the accepted value	1 point

Example: If the accepted value is seven and the response given is 7; then five (5) points are awarded. A response of 6 or 8 receives three (3) points and a response of 5 or 9 receives one (1) point. Ties are broken by counting the highest number of answers that receive five (5) points. If the number of 5-point answers is the same, time is used as the second tiebreaker.

Possible Resources: **The Lore of Large Numbers** by Philip J. Davis (**Paperback** - July 1978)  
See for lessons and examples: <http://www.soinc.org/fermiq/index.htm>

## FIVE STAR SCIENCE

### DESCRIPTION:

Teams will compete in an academic pentathlon to demonstrate their overall understanding of five major science content areas.

NUMBER OF PARTICIPANTS: 2

APPROXIMATE TIME: 50 minutes

### THE COMPETITION:

1. The event is divided into five stations. The five stations will be Biology, Chemistry, Earth Science, Physics, Inquiry and Data Analysis. The time will be divided equally between the five stations, and each station will have the same total score value.
2. The stations will be based on materials commonly covered in a high school course in the area.
3. The stations may be activity based or paper and pencil, or a combination of the two.
4. Calculators, other than graphing and programmable, may be used. Students may bring prepared notes that will fit in a one inch binder and drawing materials (including, but not limited to: rulers, curves, triangles, etc). Books and published materials and computing devices or electronic data sources are not permitted.

SCORING: The team with the highest score will be the winner. Ties are to be broken by the use of pre-selected portions from the five stations.

↓ BASE ON CONTENT OF OTHER EVENTS

STUDENT DEVELOPED NOTES, HANDWRITTEN RESOURCES

12" x 12" x 1" BOX

## FOOD SCIENCE-C

**DESCRIPTION:** Students will be asked to answer questions and perform experiments pertaining to food chemistry. This event will consist of a laboratory part and written question part. These questions will be at stations in the event as well as the laboratory activities.

**SAFETY REQUIREMENTS:** Students must wear the following or they will not be allowed to participate: close-toed shoes, OSHA approved chemical splash goggles with indirect vents, pants or shorts that cover the legs to the ankles and a lab coat or apron that reaches below the knees. Gloves are of the type that cover the hands and wrists. Students who unsafely remove their safety clothing/goggles or are observed handling any of the laboratory equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing down the drain and not rinsing them into a designated waste container provided by the supervisor) will be disqualified from the event. **EVENT PARAMETERS:** The students must supply a pen or pencil and are advised to bring a non-programmable calculator. Any non-programmable calculator, including those with memory keys for storing intermediate results, is permissible. The event supervisors will supply all other necessary materials, equipment, and reagents.



**A TEAM OF:** up to 2

**APPROXIMATE TIME:** 50 minutes

**THE COMPETITION:**

Foods are made up of at least three major food groups or classes of compounds: carbohydrates, proteins, and lipids. At each station, students will be asked to perform a laboratory task and/or answer written questions about food chemistry. The competition will consist of a series of stations that include activities similar to those in first year high school science courses. These stations could include hands-on activities, interpretation of experimental data (graphs, diagrams, etc.), and/or observation of an experiment set up and running. Supervisors are encouraged to use computer or calculator sensors/probes wherever possible or provide students with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in a tabular and/or graphic format and students will be expected to interpret the data. All measurements must be recorded with correct significant figures and units. All calculations must also include correct significant figures and units. Stations might include the following topics or activities: simple tests for proteins, lipids, and various carbohydrates. Absolutely no reference materials, scientific instruments, or other resource materials will be admitted.

### SAMPLE TASKS AND LABORATORY EXPERIMENTS:

- ◆ When given several food samples, students will be expected to distinguish between lipids, carbohydrates and proteins using typical reagents such as Benedict's solution, Biuret solution, Lugol's iodine, Sudan IV etc.
- ◆ Explain how the reagents work in order to identify the different foods, e.g., the reaction involved.
- ◆ When given generic structural formulas for each major food group, students will properly distinguish between the three food groups.
- ◆ Based on the general structures of an amino acid, explain why they have acidic and basic characteristics and how this is involved in forming the protein
- ◆ When given samples of sugars, students will properly identify the sugar as reducing or non-reducing sugars, and/or monosaccharide or polysaccharides.
- ◆ When given a food sample, students will experimentally determine the caloric value of the foodstuff.  
Reference for calorimeter: <http://www.woodrow.org/teachers/chemistry/institutes/1988/foodheat.html>
- ◆ When provided with a food sample such as popping corn, students will determine the amount of moisture in a known sample.
- ◆ Determine the density of a food sample.
- ◆ Determine and explain boiling point differences in various solutions containing different solutes.
- ◆ Determine the amount of various constituents (iron, Vitamin C, etc) in foods when given laboratory instructions
- ◆ Determine and explain the different melting points in various fats.

**SCORING:** The laboratory part of the activity will count at least 75% of the total points. The remaining 25% will be based on the questions, which will be at some of the stations. Points will be awarded for correct answers and/or proper techniques. Cleanup must occur after all laboratories are completed and failure to do this will result in a penalty. All measurements and calculations must be recorded in the correct significant figures and units. All ties will be broken by selected questions chosen by the supervisors. These questions will not be identified to the students. Possible References: Flinn: Chemistry of Food (AP4274), Chemistry of Food Additives (AP42755), and Chemistry of Beverages (AP4282).

## FORENSICS

**DESCRIPTION:** Given a scenario and some possible suspects, students will perform a series of tests. These tests, along with other evidence or test results will be used to solve a crime. **Students may bring one 8.5 X 11 sheet of paper with hand written notes, and a non-programmable calculator.**

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 minutes

**SAFETY REQUIREMENTS:** Students must wear pants or skirts that cover the legs to the ankles. In addition, students must bring and wear a lab coat or apron that reaches below the knees. Students must wear closed toed shoes and OSHA approved non-vented or indirect vented chemical splash goggles. Students who fail to meet any of the above safety requirements will not be allowed to participate. Tasting or touching the chemicals will result in disqualification. Gloves are optional. Students who unsafely remove their safety clothing/glasses will be disqualified from the event. Anyone observed handling any of the material or equipment in a hazardous manner will be disqualified.

Students **may** bring: Test tubes and test tube holders or any devices in which they can perform the tests, droppers, funnel (s), filter paper, pH or litmus paper, spatulas, plastic spoons or stirring rods, 9 volt conductivity tester (no testers will be allowed that run on AC current), thermometer, flame test equipment (nicrome wire, cobalt blue glass, etc.), slides, ruler, hand lens, pencil, paper towels, and metal tongs. (Students not bringing these items will be at a disadvantage. The event supervisor will not provide them.) **Supervisor will provide:** Iodine reagent (Iodine dissolved in KI solution), 2M HCl, 2M NaOH, Benedict's solution, (no more than 50 mL of each of the solutions) a hot water bath, a heat source to perform flame tests, a method that may be used for differential density tests, and distilled water (no more than 250 mL). The supervisor will provide a candle and matches for burn tests on the fiber samples. The supervisor may provide other equipment (such as a microscope) or reagents to perform additional tests.

**THE COMPETITION:** There will be 4 parts and then the Analysis of the Crime. **The event will consist of evidence from the first three parts and up to 2 parts from Scene Physical Evidence at Regional, 3 parts from Scene Physical Evidence at State and 4 parts of Scene Physical Evidence at National.**

**1. Qualitative Analysis:** Substances to identify: sodium acetate, sodium chloride, sodium hydrogen carbonate, sodium carbonate, lithium chloride, potassium chloride, calcium nitrate, calcium sulfate, calcium carbonate, cornstarch, glucose, sucrose, magnesium sulfate, boric acid, and ammonium chloride (there will be no mixtures). The team will be provided with up to 5 powders at Regional (8 at State and National) of the 15 substances listed above. All teams will have the same set of solids to identify. No more than 15 g of each substance will be given to the team.

**2. Polymer Testing-Natural & Man-made:** Substances to identify: PETE, HDPE, PS, LDPE, PP, PVC, PMMA and PC. Students will be provided with up to 3 Regional, 4 State, & 5 National polymer samples found at the crime scene. Students are to use density tests and characterizations of each sample to help identify the polymer found at the crime scene. Results of burn tests of each sample may be given. No actual burn tests will be performed on PETE, HDPE, PS, LDPE, PP, PVC, PMMA or PC. Students should have knowledge of the applications of these polymers. Students will be given up to 2 Regional, 3 State and 4 National samples of cotton, wool, silk, nylon, spandex, or polyester. Students will be expected to test the fibers by performing burn tests on the above fibers and using their senses to help identify the fibers. Students may be expected to explain their answers. Students will be given up to 2 hair samples at Regional, 3 State, and 4 National. The hairs may be human, cat, or dog.

**Substances to identify:** PETE, HDPE, PS, LDPE, PP, PVC, PMMA, PC, cotton, wool, silk, linen, nylon, spandex, polyester, human hair, dog hair, and cat hair. Students may not perform any burn tests on the PETE, HDPE, PS, LDPE, PP, PVC, PMMA or PC. Burn test results on these may be provided by the event supervisor. Students may use density tests, their senses, or other

characterizations of the samples to identify them. Burn tests will be permitted on the fibers. Students will be given up to 7 samples at Regional, 10 at State, and 13 at National competitions.

3. **Chromatography/Spectroscopy:** Students may be expected to separate components using paper chromatography and/or analyze gas chromatograms, mass spectra, UV and/or IR spectra. Students may be expected to do paper or thin layer chromatography and measure  $R_f$ s.

4. **Scene Physical Evidence:**

a) **Fingerprint Analysis:** Students may be asked to identify different patterns on fingerprint evidence. Students should understand terminology such as bifurcation, ridges, island, enclosure, loop, whorl, and arch. Students should be able to answer questions about skin layers and how fingerprints are formed. Students may be asked questions on the different methods of detecting fingerprints and the chemistry behind each of these methods.

b) Students may be asked to compare DNA chromatograms from blood found at the scene to those of the suspects.

c) **Glass analysis.** Students may be asked to use index of refraction to determine the type of a glass found broken at a crime scene. They may be asked to analyze which hole or fractures occurred before others based on a piece of glass available for examination or a picture of a piece of glass.

d) **Entomology.** Students may be asked to identify how long an animal has been dead based on the type of insects found on the body at the scene.

e) **Spatters.** Students may be asked to analyze actual spatters or photographs of spatters to determine the angle and velocity with which the liquid approached the solid object bearing the spatter. "SPATTER"

f) **Seeds and Pollen.** Students may be asked to compare pictures of seeds or pollen found at the scene with either seeds or pollen found on the suspects or seeds or pollen from different regions of the country.

g) **Tracks and Soil.** Students may be asked to match tire tracks or footprints found at the scene to tires or shoes of the suspects. 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.

**Analysis of the Crime:** Students will be asked to write an analysis of the crime scene explaining not only which pieces of evidence implicate which suspect and why the suspect(s) was (were) chosen as the culprit(s), but also why the other suspects were not chosen. They will also answer any other crime scene analysis questions posed by the event supervisor.

**SCORING:** Part 1 20% Part 2 20%, Part 3 15%, Part 4 15%, and Analysis of the Crime 30%. Tiebreaker: Ties will be broken by the highest score on the analysis of the crime scene, which includes the reasons why certain suspects have been eliminated or others remain in the pool of possible criminals. A 10% penalty of may be given if the area is not cleaned up as designated by the event supervisor.

## HEALTH SCIENCE (C)

DESCRIPTION: This event encompasses basic anatomy, physiology, health and diseases of the Endocrine, Nervous, and **Circulatory** systems.

A TEAM OF UP TO: up to 2

APPROXIMATE TIME: 50 Minutes

EVENT PARAMETERS:

Teams may bring non-programmable, calculators. No printed or written resources may be used during the test.

THE COMPETITION:

Students should know the basic anatomy and physiology of the relevant body systems at rest, and apply this understanding to solve problems posed by the effects on the body systems in health and disease. **Students should be able to explain effective social strategies and make behavioral recommendations for persons with physiological disorders and the people around them.** Tests will be 20% endocrine, 20% nervous, **20% circulatory, 20% physiology of disorders, and 20% treatment and coping with disorders.** Process skills may include observations, inferences, predictions, calculations, data analysis, and conclusions.

*The following are suggested topics for state or regional contests. All topics will be used at the national level.*

### ENDOCRINE SYSTEM

*All Competition Levels:*

Definitions- Endocrine gland, Hormone, Negative Feedback, Receptor, Specificity

Activity- Permissive effects, Activational vs. Organizational, Synergistic, Antagonistic, Priming, Desensitizing

Regulation of Hormone Secretion- Hypothalamus, Pituitary, Releasing/Tropic Hormones

Peripheral Endocrine Organs- Anatomy, Match hormones to glands that secrete them, basic definition or role of hormones (adrenal gland, thyroid, parathyroid, thymus, pineal gland, pancreas, testes, and ovaries)

*State/National Competition Level Only:*

Classification of Hormones- classify hormones based on their chemical structure (i.e. peptide/protein, monoamine, steroid, thyroid hormone, or eicosinoid);

Chemical Implications of Hormone Class- lipophobic vs. hydrophobic, extracellular receptors vs. intracellular

receptors, blood transport and diffusion, genomic vs. non-genomic actions, fast-effects, half-life; Non-classical

Endocrine Organs- all hormones (Gastrointestinal Tract, heart, adipose tissue, etc.);

Hormone Systems- ONLY THESE THREE: stress response, insulin and glucagon, and calcium regulation

*National Competition Level Only:*

Mechanisms of hormone action- secondary messenger systems, steroid receptors, response elements, etc.

Hormone Systems- all systems and functions

### NERVOUS SYSTEM

*All Competition Levels-The Brain-* basic function and identification of cerebral lobes, cerebellum, and brain stem, identification of simple encelographic waveforms

Neural Impulses- Action potential generation and propagation, ionic basis of the cellular membrane potential, cellular anatomy and physiology of neurons

*State/National Competition Only:*

Central Nervous System- organization of the spinal cord, purpose/functions of sleep

Peripheral Nervous System- neuroganglia, action of sensory and motor neurons, understand differences in and purposes of parasympathetic, sympathetic, somatic, and sensory systems

Neural Impulses- Cellular anatomy and physiology of glial and supporting cells, synapses and neurotransmitters

*National Competition Only:*

The Brain- anatomy and physiology of brain function including function and role of specific nuclei clusters and tracts, theories of dreaming, purpose and principles of MRIs and EEGs

Neural Impulses- Retrograde signaling, neuromodulators, SSRI/MAOI antidepressants

## CIRCULATORY SYSTEM

### *All Competition Levels:*

The Heart- chambers and valves of the heart, electrical stimulation of myocardio tissue

Blood Vessels- arteries, arterioles, veins, venules, capillaries

Blood- plasma, hematocrit, red blood cells, ABO-blood typing, Rhesus factor, oxygen transport, hemoglobin

### *State/National Competition Only:*

The Heart- pacemaker tissue, interpreting ECG (EKG) readings

Blood- platelets and blood clotting, regulation of blood plasma volume and acidity, MN-bloodtyping, basic genetics of ABO, Rh, and MN bloodtypes (ONLY) including paternity mysteries

### *National Level Only:*

Blood Vessels- continuous vs. fenestrated capillaries, blood brain barrier

Lymphatic System- white blood cells, lymph nodes, lymph ducts, lymphatic capillaries, lymphoid organs (spleen, thymus), tissue fluid

## DISEASE AND TREATMENT

*All Competition Levels* - Diabetes Mellitus, Narcolepsy, Epilepsy and Seizures, Sleep Deprivation, Iron-Deficient Anemia, Sickle-Cell Anemia

*State/National Levels* - Neurodegenerative Diseases (Alzheimer's Disease, Huntington's Disease, and Parkinson's Disease), Hemophilia, Arterial Sclerosis, Erythroblastosis Fetalis

*National Level Only* - Thyroid Disorders, Congenital Adrenal Hyperplasia, Biological Basis of Schizophrenia, all diseases and disorders relevant to the endocrine, nervous, and circulatory systems are potential topics for national finals, however primary emphasis will be on those listed above.

## SAMPLE TOPICS FOR ALL LEVELS:

- If a child is born with no endogenous insulin, they suffer from \_\_\_\_\_. (Diabetes Mellitus Type I)
- Advanced/severe diabetes is likely to cause what symptoms? (Polydypsia, polyphagia, and polyuria)
- Melatonin is associated with which endocrine gland? (The Pineal Gland)
- Given a case study, advise a diabetic as to whether or not they must perform daily blood sugar testing.
- Given a diagram of the brain, label the lobes of the cerebral cortex and draw a line through the central sulcus.
- Interpret and explain graphs of neural action potentials, including implications for ion concentration and flow.
- Identify a disorder or dysfunction based on a picture of a patient.
- A man with type AB+ blood needs to receive a blood transfusion. What blood-types can donate blood? (all)
- What happens to hemoglobin in sickle cell anemia? Identify sickled-cells from microscope images.
- Given a diagram of the heart, label the chambers and illustrate blood flow.
- What is the employability of a narcoleptic with cataplexy (or epileptic) who hopes to work as a medical doctor? Is this possible? If so, what accommodations might be required?
- Evaluate a patient with narcolepsy (or with epilepsy) on their competence to drive a car.
- In the treatment of epilepsy, anti-seizure drugs act on voltage-gated ion channels in order to \_\_\_\_\_. (stabilize the inactive state of the ion channel, meaning fewer channels are available to open)

## SAMPLE TOPICS FOR STATE/NATIONAL LEVELS:

- This hormone causes a reduction in blood volume and therefore central venous pressure, cardiac output, and arterial blood pressure. It also increases renal sodium secretion and excretion. (Atrial Natrietic Hormone)
- What is the function of the liver hormone thrombopoietin? (stimulates platelet production in bone marrow)
- Identify the role of a chemical in the body based on its chemical structure. THIS DOES NOT INVOLVE THE MEMORIZATION OF SPECIFIC CHEMICAL FORMULAS AND/OR STRUCTURES. For example, students should know the general form of a steroid, not the specific atomic structure of testosterone.

SCORING: Points are awarded for correct answers. Ties are broken based on quality of free-response answers.

## OCEANOGRAPHY C-Division (Revised 6/13/06)

**DESCRIPTION:** This event emphasizes the use of process skills to complete tasks related to **physical oceanography**.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 Minutes

**EVENT PARAMETERS:** Teams may bring a non-programmable calculator, plus handwritten, typed, or computer-generated resources, including books, to the event. All resources must fit within the confines of an area no larger than 12" x 12" x 3".

**THE COMPETITION:** Participants will be presented with one or more tasks, each requiring the use of process skills. These skills include, but are not limited to, generating inferences, making predictions, problem solving, making and recording observations, formulating and evaluating hypotheses, interpreting data, and graphing. This event may be administered in a timed station-to-station format.

### **PARTICIPANTS MAY BE TESTED ON ANY OR ALL OF THE FOLLOWING TOPICS:**

- Seawater: composition, dissolved gases, pH, density, variations in salinity, sources of salts
- Water temperatures and the three-layered structure of ocean water
- Topographic features found on the continental margins, ocean basins, and mid-ocean ridges
- Oceanic-oceanic and continental-oceanic plate convergence and divergent plate boundaries
- Weather and climate: land and sea breezes, hurricanes, El Niño, La Niña
- Waves: heights, wavelength, period, motions, breakers, surf
- Currents: longshore currents, rip currents, surface circulation, thermohaline circulation, and turbidity currents
- Tides: high and low tides, spring and neap tides, diurnal and semi-diurnal tides, and tidal currents
- Tsunamis

\*Note: Topics for B and C divisions are significantly different.

### **REPRESENTATIVE ACTIVITIES:**

Given a diagram of the Galapagos Spreading Center, compare and contrast the motion of the ridge segments with that of the transform fault. A diagram and information about this activity may be found at: [http://www.oceanexplorer.noaa.gov/explorations/02galapagos/background/education/media/gal\\_gr9\\_12\\_12.pdf](http://www.oceanexplorer.noaa.gov/explorations/02galapagos/background/education/media/gal_gr9_12_12.pdf)

**SCORING:** Points will be awarded for the quality and accuracy of responses. Ties will be broken by the accuracy or quality of answers to selected questions.

### **RESOURCES:**

<http://www.nos.noaa.gov/education/kits/tides/welcome.html>

<http://www.noaa.gov/ocean.html>

<http://oceanexplorer.noaa.gov>

<http://www.onr.navy.mil/focus/ocean/motion/default.htm>

**NATIONAL SCIENCE EDUCATION STANDARDS:** Content Standard D. Earth and Space Science: Energy in the Earth System; Origin and Evolution of the Earth System.

## PHYSICS LAB

DESCRIPTION: Students will compete in lab activities in the area of ~~linear~~ **rotational** motion.

EVENT PARAMETERS: Students may bring and use any non-programmable calculator. No other resource material may be used unless provided by the event supervisor.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 50 Minutes

THE COMPETITION: The competition will consist of experimental tasks and questions related to ~~motion along non-rotational trajectories in one (1) or two (2) dimensions.~~ **rotational motion about a fixed axis. Note that the term “fixed” refers to the orientation of the axis and not to its position. Hence rolling objects are included.** Some mathematical relationships may be provided at the discretion of the event supervisor, but students are expected to know the basic concepts, definitions and mathematical statements involved. They are expected to know: the basic equations of motion involving constant **angular** acceleration, ~~Newton's laws of motion, the basics of describing motion in two dimensions,~~ momentum, impulse, **moment of inertia, torque, rotational work, rotational kinetic energy, gravitational potential energy, potential energy stored in springs, work done by a constant friction force, the conservation of momentum and conservation of mechanical energy (including energy lost due to friction) and Power. All answers will need to be provided in SI units (such as **radians, kg-m<sup>2</sup>, Newton-meter, Watts, Joule, Newtons, kilograms, meters,** and seconds) with proper significant figures.**

SAMPLE STATIONS: (This list is not intended to be an exhaustive list of possible stations.)

- ~~1 Analyze a graph of projectile motion to determine the initial velocity and/or launch angle and/or x and y component velocities at various locations and/or times.~~
- ~~2 Analyze motion of a cart on an inclined plane to determine acceleration and/or velocity at various locations.~~
- ~~3 Analyze the collision of two carts to determine the velocity change of each cart, impulse on carts, average force during collision and/or kinetic energy loss.~~
- 1 The measurement and/or calculation of centripetal force**
- 2 The measurement and/or calculation of moment of inertia**
- 3 The measurement and/or calculation of angular momentum or conservation of angular momentum**
- 4 Determine the mechanical advantage and efficiency of a gear train and/or pulley and belt systems.**
- 5 The measurement and/or calculation of torque**

Where feasible, supervisors are encouraged to provide students with brief demonstration(s) of data collection by computer and/or calculator sensors/probes followed by distribution of previously prepared data sets. If used, data will be presented to students in a tabular and/or graphic format(s) and students will be expected to analyze and/or interpret the data.

SCORING: Points will be awarded for correct answers, measurements, calculations, and analysis of data. Supervisors are encouraged to provide a standardized form on which students can show all measurements and calculations. Ties will be broken using a designated task(s) or question(s) that may be noted on the student answer form.

**National Science Education Standards: Physical Science CONTENT STANDARD B: As a result of their activities in Grades 9-12, all students should develop an understanding of interactions of energy and matter.**

✓ WRIGHT CENTER  
 ✓ MICHIGAN SO. ONLY

## REMOTE SENSING

**DESCRIPTION:** Participants will use satellite imagery of the planet Mars and a USGS Mars Topographic Map to interpret geologic features, answer questions, or solve one or more problems. The activity may be presented in a story-line format.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 50 minutes

**EVENT PARAMETERS:** Participants are encouraged to bring protractors, calculators, rulers, and student-created notes. All resources must fit within the confines of an area no larger than 12" x 12" x 3".

**THE COMPETITION:** Using the USGS Mars Topographic Map and a combination of satellite imagery of the planet Mars acquired during one or more NASA missions, participants will determine the coordinates of selected features and describe geologic processes associated with their formation. Participants will use science process skills to include making and recording observations, interpreting data and graphing to complete one or more required tasks. All maps and images required to complete tasks will be provided. This event will address only geologic features of the planet Mars, and will make comparisons with similar geologic features on Earth. Participants are not to mark on the maps, photographs or images.

**QUESTION AREAS MAY INCLUDE:**

1. Martian Terrain Analysis
2. Satellite imagery and the Electromagnetic Spectrum.
3. Locating and interpreting features
4. Mars exploration
5. Determining distance between features
6. Determining the scale and area of features
7. Using the Mars Coordinate System to locate features
8. Determining slope (feet per 100) of features
9. Comparisons of Martian and Earth geologic features

*Handwritten notes:*  
 EARLY 5000 AS USUAL  
 AUG 28  
 \* 5 WEEK COURSE  
 1. INTRO TO MARS  
 2. COORDINATES OF SELECT. FEAT.  
 3. ANALYSIS OF FEAT.  
 4/5 FOR EVENT SUPERVISOR (CREATE TASKS)  
 MARTIAN ERAS  
 1. NOBILIAN  
 2. HESPERIAN  
 3. AMAZONIAN  
 GEO HISTORY  
 \* ADD GEOLOGIC ERAS (3 FOR MARS)  
 \* POSSIBLE STATION FORMAT  
 \* CHECK SITE FOR MORE INFO (WRIGHT CENTER SITE)

**SCORING:** The number of correct responses determines ranking in the competition. A minimum of three pre-identified questions and categories of questions will be used as tiebreakers.

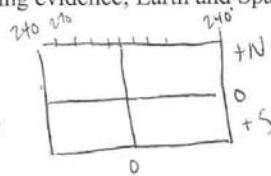
**SUGGESTED RESOURCES:**

USGS Mars Topographic Map (to be used in all competitions-single copy \$14.00)  
 Science Olympiad Remote Sensing of Mars Coach's Manual-see [www.soinc.org](http://www.soinc.org)  
<http://cmex-www.arc.nasa.gov/CMEX/index.html>  
<http://mars.jpl.nasa.gov>

*Handwritten notes:*  
 4. CURRENT EVENT (RECENT MISSIONS) POWERS  
 OTHER PROPOSED TOPICS  
 1. EXPAND/SIMILAR OF POLAR OF MARS  
 2. DETERMINATION OF MARS - MARTIAN ATMOSPHERE STRUCTURE - COMPA  
 3. VOLCANISM - TYPES / FORMATION

**National Science Education Standards:** Science as Inquiry Content Standard A: Develop descriptions, explanations, predictions and models using evidence; Earth and Space Science Content Standard D Origin and Evolution of the Earth System

*Handwritten notes:*  
 \* "GOOGLE MARS"  
 \* NASA REMOTE SENSING TUTORIAL INCLUDING MARS  
 \* NINE PLANETS WEBSITE



*Handwritten notes:*  
 \* DATES NOT RELEVANT  
 \* WHAT DID MISSIONS TELL US?

*Handwritten note:*  
 AND WIKIPEDIA.COM → MAKE GEO BOOK ON MARS

## 2007 ROBOT RAMBLE

**DESCRIPTION:** The object of this event is to design and build a robot capable of performing certain tasks on a prescribed playing field. Each team may enter only one robot that must be built prior to the competition.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 5 minutes/Team

**IMPOUND:** Yes

### 1) **MATERIALS:**

- a) A team may enter only one robot for this event.
- b) The robot may be constructed of any material (R/C vehicle, plastic, metal, Plexiglas, Legos, wood, K-nex, Robotix, Erector set, Vex, etc.).
- c) The robot may be controlled remotely (Radio control, infrared, etc.) and/or with a battery powered (9.6 volts or less) control box that has wires leading to the robot.
- d) At the start of the competition, there is a size restriction for the robot. The robot must be able to fit into a cube with inside dimensions of 30 cm x 30 cm x 30 cm, with the exception of the wires that connect to the student control box(es).
- e) The robot circuits must be energized by one or more commercial batteries with a voltage not to exceed 9.6 volts. The voltage stated on commercial batteries will be accepted.
- f) If multiple batteries are used, they may be connected in series or parallel as long as the voltage output does not exceed 9.6 volts.
- g) Each robot function (such as drive train, arm, etc.) may have its own independent circuit, source of electrical energy, and control mechanism.
- h) Hydraulics, pneumatics, and fluidics will not be allowed. Only electric circuits may be used in the activation of the robot.
- i) If the robot is "radio-controlled" (R/C), systems may be controlled by more than one transmitter. Each transmitter must be energized by one or more commercial batteries with a total voltage not to exceed 9.6 volts per transmitter.
- j) The robot must have a legible team name on it.
- k) Radio control equipment used for this event must operate on frequencies designated by the Federal Communications Commission (FCC) regulations for surface devices (cars, boats, etc.). The frequency must be marked by the manufacturer on the transmitter. Allowable frequencies are:
  - 75 Mhz band (75.41 through 75.99 Mhz), which contains 30 channels
  - 27 Mhz band (26.995 through 27.255 Mhz) may be used but is not encouraged for the competition.

- 49 Mhz band (49.8302 through 49-890) may also be used but is not encouraged for the competition. This band is generally used by the toy industry for Radio Controlled (R/C) toys.

NOTE: 72.0 Mhz band through 73.0 Mhz band is restricted by the FCC for R/C model aircraft and cannot be used for the competition. Teams using this band may not compete in the event. It is illegal to use this Band for surface craft and the user is subject to a penalty by the FCC.

2) **PLAYING FIELD** See <http://www.soinc.org/robotram/> for a diagram of the Playing Field

- a) The playing field for the event shall be constructed on a piece of smooth, dense, short nap carpet approximately 4 feet by 8 feet.
- b) The playing field will be marked on the carpet with a permanent ink-marking pen. Each line on the playing field will be approximately 1/2 inch wide.
- c) The playing field will be a rectangular configuration one meter wide by two meters. It will be further divided into two zones by a centerline running through the center of the rectangle, making each zone one meter wide by one meter long. One zone will be Zone A and the other zone will be Zone B.
- d) Zone B will be the starting position for the robot.
- e) Zone A will contain all of the scorable items at the start of the competition. In the approximate center there will be an equilateral triangle drawn on the playing field. Each side of the triangle will be 30 centimeters in length with the side nearest the centerline being parallel to the centerline of the playing field.
- f) All materials for the event, including the playing field, qualifying box, compact disk (CD), goal box, Ping-pong balls, balloons, corks, etc. will be provided by the event supervisor.

3) **COMPETITION:**

- a) All robots and control systems must be impounded before the start of the competition and will be released after the last team has finished competing. Robots and controls entered by teams that have filed an appeal may be retained by the event supervisor until the appeal process is completed.
- b) At the start of the competition, the event supervisor will place in Zone A the following objects: 2 Ping-Pong balls (approx. diameter 38 mm), 1 compact disk (CD), 9 laboratory cork stoppers (three size No. 4, three size No. 7, and three size No. 12)-, and **10 United States copper clad penny coins.**

- c) A tower of three laboratory cork stoppers (1 ea. size No. 4, 7 & 12) will be placed on the three corners of the triangle in Zone A with the largest cork on the bottom and the smallest cork on the top. Standard sizes for corks are:
- size #4 top diameter 15mm, bottom diameter 12mm, length 20mm
  - size #7 top diameter 20mm, bottom diameter 16mm, length 25mm
  - size #12 top diameter 28mm, bottom diameter 23mm, length 31mm
- d) A standard (12 cm diameter) Compact Disk (CD) will be placed flat, **label side up**, on the playing field in the center of the equilateral triangle. A **stack of 10 pennies** will be placed on top of the CD **on the alignment hole**.
- e) Two Ping-pong balls will be placed on the line that divides Zone A from Zone B. One will be placed 3 inches from each end.
- f) A goal "box" with inside dimensions of 30 cm x 30 cm x 30 cm, with no bottom or top will be placed inside of the playing field with an open side up **in the middle of the center of the line that divides Zone B and Zone A in a diagonal configuration so that the two opposite corners are both on the center line**. The goal box must be made of Plexiglas.
- g) The competing team will inflate and tie off three circular **9" blue balloons** and place them in the goal box **along with one red 9" balloon**. The balloons must be completely within the box with no parts extending out of the box. **The 9" refers to the manufacturer's recommended maximum inflated diameter of the balloon. Inflation of the balloons is at the discretion of the team. The size that the balloons are inflated to is a strategy that needs to be developed by each team. The balloons can be inflated to the same or all different sizes as long as all four inflated balloons fit completely into the goal box.**
- h) The goal box must remain inside of the playing field. **The robot may move the goal box but, if it is pushed out of bounds by the robot, the competition stops and the score is determined at that point (since the goal box is out of bounds the contents will receive no points).**
- i) **The goal box must remain in the upright position. If it is turned on its side, the competition ceases at that point and the score will be determined prior to the violation (Tipping the goal box on its side).**
- j) **At the start of the competition, students will place their robot in the designated starting position inside of the playing field at the center of the end boundary line of Zone B**
- k) Once the robot is in place, the student will place a qualifying cube over the robot. The qualifying cube will be 30 cm x 30 cm x 30 cm and constructed of Plexiglas. If the robot fits

in the cube, the competition will continue. If the robot does not fit in the cube, the students will be allowed to compete but their robot will be ranked behind all of the other robots that qualify by fitting into the qualifying cube.

- l) **The students will then remove the cube. After the qualifying cube is removed, the robot may self-activate a change in size or shape. These changes may not be activated mechanically or electronically by the student until the two-minute competition begins. At this point, students may not touch their robot. Now that the qualifying cube has been removed, the competition will start by having the judge acknowledge that the students are ready, then count aloud 1, 2, 3, go. When the judge says "go", the judge will start the stopwatch to begin the 2-minute competition.**
  - m) During the two-minute competition, the robot must pick up the items that are in Zone A and place them in the goal box. The robot may pick up the scorable items individually or collectively.
  - n) Miscellaneous robot parts, or the entire robot, may end up in the goal box without penalty.
  - o) At the end of two minutes, points will be awarded based on the number and types of items that were placed in the goal box. If any part of the box is out of bounds, the scoreable items within will have no point value.
  - p) If a scorable item (ping-pong ball, CD, pennies, or corks) is moved by the control wires, it will become out of play and may not be used to attain any points.
  - q) If a student touches or uses the wires or control box to physically move the robot, the competition ceases at that point and the score will be determined prior to the violation (touching the robot).
  - r) At the end of the competition, the event supervisor will allow 10 seconds for the robot to "come to rest" with the power off to determine if any parts are touching the ground outside of the playing field.
  - s) The robot must also break the three blue balloons that are in the goal box to add 20 points per broken balloon to the team's score. **The robot must remove the entire red balloon from the goal box in order to get the 40 points.** The goal box and robot must be in bounds when the balloons are deflated by the robot.
- 4) SCORING:
- a) Any scorable item that breaks the plane of the outer boundaries of the playing field, even if it is under the control of the robot, it is out of play and may not be used to attain any points.
  - b) A team will receive the following points for each item placed in the goal box:
    - 2 Ping-pong balls = 10 points, maximum 20 points
    - 10 Pennies = 5 points, maximum 50 points

- 1 Compact Disk (CD) = 25 points, maximum 25 points
  - 9 Corks = 5 points, maximum 45 points
- c) For every scoreable item removed from Zone A and placed in the goal box or in Zone B, the team will receive 1 point (maximum **22** points).
- d) If the robot deflates the **blue** balloons in the goal box, the team will receive 20 points for each of the **blue** balloons that is deflated (60 possible points).
- e) **If the robot removes the one red balloon from the goal box, the team will receive 40 points. NOTE: If any parts of the red balloon remain in the goal box, the team will receive none of the 40 allowable points.**
- f) At the end of the competition, if the robot (parts touching the ground) is completely in **Zone A or the Goal Box**, the team will receive **15** points.
- g) The goal box will be considered part of the playing field and must be in bounds at the end of the competition in order for the scorable items that it contains to have any point value.
- h) The team with the most points will be the winner. In the case of a tie, the team that completed the task in the shortest length of time will receive the more favorable score value. If teams still have identical scores, the tie will be broken by massing the robot—which includes robot and batteries). The robot and its batteries with the least mass will receive the more favorable score value (ranking).
- i) Robots that fail to meet any of the specifications under “Materials” will be allowed to compete but will be ranked behind those that do.
- j) Robots that violate the FCC regulations will not be allowed to compete and will receive participation point(s) only.
- k) Maximum score:
- All items removed from Zone A to Zone B or Goal Box = **22** points
  - 1 Golf ball = 15 points **10 Pennies = 50** points
  - 2 Ping-Pong balls = 20 points
  - 1 Compact Disk (CD) = 25 points
  - 9 Corks = 45 points
  - 3 **Blue** Balloons Deflated = 60 points
  - 1 Red Balloon Removed entirely from Goal Box = 40 points
  - Robot in the **Goal Box or Zone A** of the playing field at the end of the 2 minute event = **15** points

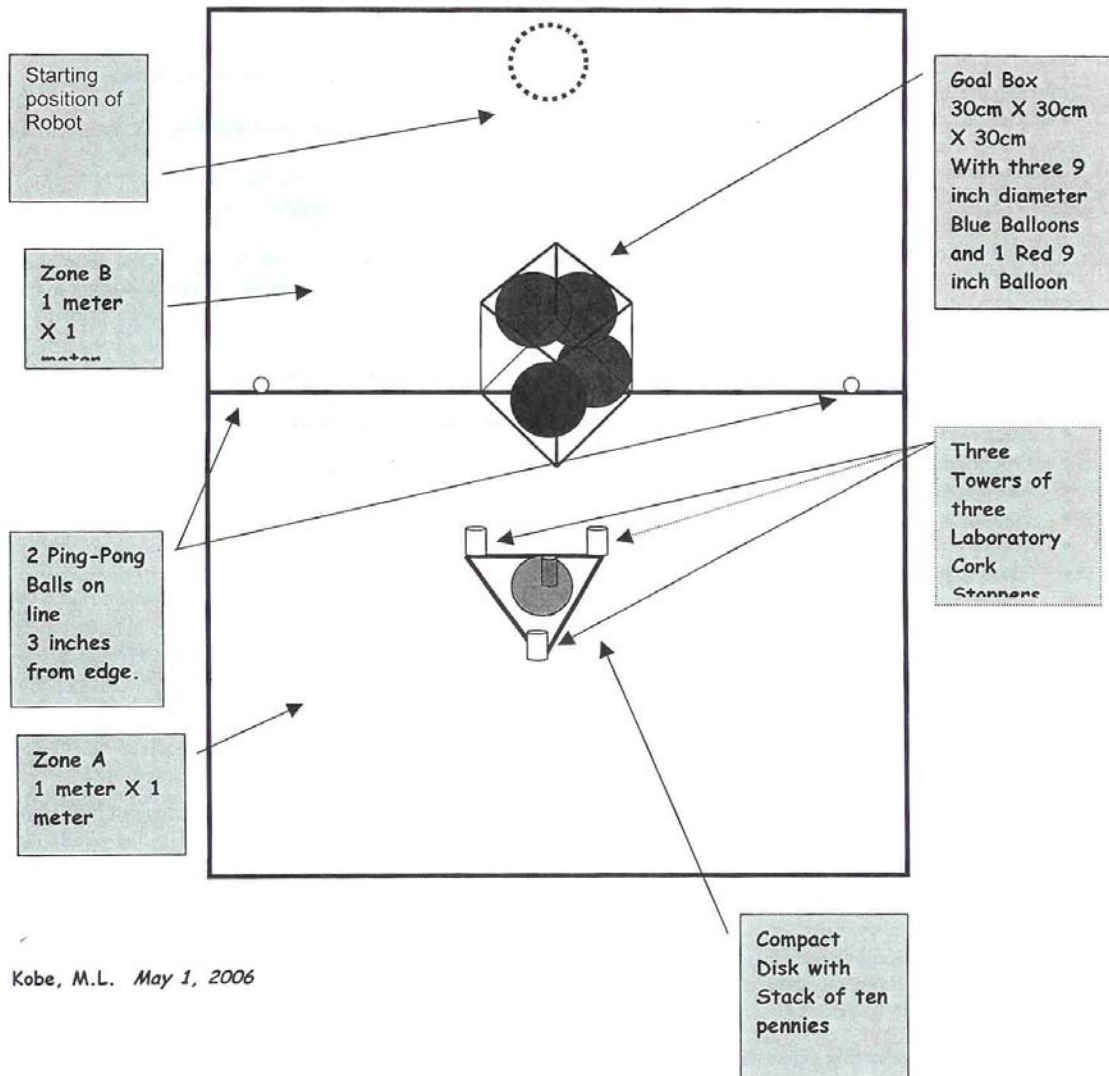
Maximum Scores

Item	Quantity	Value	Points
Items removed from Zone A	22	1	22
Pennies	10	5	50
Ping-Pong balls	2	10	20
Compact Disk	1	25	25
Corks	9	5	45
Deflated Blue Balloons	3	20	60
Red Balloon removed from Goal Box	1	40	40
Robot in zone A		15	15
Total Points			277

Kobe, M.L. June 30, 2006

# Robot Ramble 2007 Playing Field

One meter by two meter rectangular playing field



Kobe, M.L. May 1, 2006

## ROCKS AND MINERALS (Revised 6/26/06)

**DESCRIPTION:** Teams will demonstrate their knowledge of rocks and minerals in a station-based format.

**A TEAM OF UP TO:** 2

**APPROXIMATE TIME:** 40-50 Minutes

**EVENT PARAMETERS:** With the exception of pens or pencils, fingernails, and hand lenses, only those tools provided by the supervisor may be used. Participants may bring any student developed or purchased reference materials that fit within the confines of an area no larger than 12" x 12" x 3".

### **THE COMPETITION:**

1. 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.
2. Participants may not move to the next station until prompted to do so, may not skip stations, nor return to any previously visited station.
3. Specimens and other materials placed at the various stations may not be taken to other stations.
4. 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.
5. Only those specimens appearing on the **Official NSO list** (see [www.soinc.org](http://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 within six weeks prior to the tournament.

### **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 (C-Division only)
  - Bowen's reaction series (C-Division only)
- PHYSICAL GEO LAB MANUAL, LEVIN*  
*EARTH THROUGH TIME, EARTH SYSTEMS INC*

### **REPRESENTATIVE STATION ACTIVITIES:**

1. 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.
2. Match each metamorphic rock with the type of rock from which it may have been formed.

**RESOURCES:** **Rocks and Minerals kits** (\*excluding only silver, gold, and diamond) may be purchased from either ESES, P.O. Box 503, Lee's Summit, MO 64063 (No Phone Orders-PH 816-524-5635; FAX 816-525-4263) item OLY01 at \$75.00. Prices quoted include shipping and handling. **Recommended Field Guide:** National Audubon Society Field Guide to North American Rocks and Minerals and **SO Rock and Mineral Teaching Guides** at [www.soinc.org](http://www.soinc.org)-see store.

**Sample exams.** [http://www.tufts.edu/as/wright\\_center/fellows/sci\\_olympiad/sci\\_olympiad\\_geo.html](http://www.tufts.edu/as/wright_center/fellows/sci_olympiad/sci_olympiad_geo.html)  
<http://regentsprep.org/Regents/earthsci/units/rocks/rocks.cfm>  
<http://regentsprep.org/Regents/earthsci/units/rocks/minerals.cfm>  
<http://bcs.wiley.com/he-bcs/Books?action=chapter&bcsId=2757&itemId=0471697435&chapterId=21544>

**SCORING:** Rankings in this event will be determined by total scores. Ties will be broken by the accuracy or quality of answers to selected questions.

**NATIONAL SCIENCE EDUCATION STANDARDS:** Earth and Space Science, Content Standard D: Structure of the Earth System; Earth's History; Earth in the Solar System. (5-8); Earth and Space Science, Content Standard D: Energy in the Earth System; Geochemical cycles. (9-12)

## 2007 Official Science Olympiad Rock and Mineral List

### Minerals

1. Albite [Plagioclase Group]
2. Almandine [Garnet]
3. Amazonite [Microcline]
4. Apatite
5. Aragonite
6. Augite
7. Azurite
8. Bauxite
9. Barite
10. Beryl
11. Biotite [Mica]
12. Bornite
13. Calcite
14. Celestite
15. Chalcopyrite
16. Copper
17. Corundum
18. Diamond\*
19. Dolomite
20. Epidote
21. Feldspar [Orthoclase Group]
22. Fluorite
23. Galena
24. Goethite
25. Gold\*
26. Graphite
27. Gypsum [Alabaster]
28. Gypsum [Satin-Spar]
29. Gypsum [Selenite]
30. Halite
31. Hematite
32. Hornblende
33. Kaolinite
34. Lepidolite
35. Magnetite
36. Malachite
37. Muscovite [Mica]
38. Olivine
39. Opal
40. Pyrite
41. Quartz [Agate/Onyx]
42. Quartz [Amethyst]
43. Quartz [Chalcedony]
44. Quartz [Citrine]
45. Quartz [Crystal]
46. Quartz [Jasper]
47. Quartz [Milky]

48. Quartz [Rose]
49. Rhodonite
50. Silver\*
51. Sodalite
52. Sphalerite
53. Staurolite
54. Sulfur/Sulphur
55. Talc
56. Topaz
57. **Tourmaline Group**
58. Tremolite
59. Ulexite

### Metamorphic Rocks

60. Gneiss
61. Marble
62. Phyllite
63. Quartzite
64. Schist [Garnet]
65. Schist [Mica]
66. Slate

### Igneous

67. Andesite
68. Basalt
69. Diorite
70. Gabbro
71. Granite
72. Obsidian
73. Pegmatite
74. Pumice
75. Rhyolite
76. Scoria

### Sedimentary

77. Anthracite Coal
78. Arkose
79. Bituminous Coal
80. Breccia
81. **Chert**
82. Conglomerate
83. Coquina
84. Diatomite
85. Dolomite Rock or Dolostone
86. **Lignite Coal**
87. Limestone [Chalk]
88. Limestone [Crystalline]
89. Limestone [Fossiliferous]
90. Limestone [Oolitic]
91. Limestone [Travertine]
92. Sandstone
93. Shale

**Rocks and Minerals Kit: Item OLY01** (\*excluding only silver, gold, and diamond) may be purchased for \$75 from ESES, P.O. Box 503, Lee's Summit, MO 64063 (No Phone Orders-PH 816-524-5635; FAX 816-525-4263) Price quoted includes shipping and handling.

**Recommended Field Guide:** National Audubon Society Field Guide to North American Rocks and Minerals and SO Rock and Mineral Teaching Guides at [www.soinc.org](http://www.soinc.org)

15 2nd round 5/15/10

## SCRAMBLER '07

**DESCRIPTION:** Prior to the competition the contestants will design and build a mechanical device, which uses the energy from a falling mass to transport an egg along a straight track, stopping as close to a terminal barrier as possible without breaking the egg. The distance to be traveled will be announced at the beginning of the event after the devices have been impounded. Participants must bring and wear proper eye protection when warranted by their device.

See <http://www.soinc.org/general/protection/>

**A TEAM OF UP TO:** 2

**IMPOUND:** YES

**APPROXIMATE TIME:** 20 min.

### 1. **CONSTRUCTION:**

- a) The Scrambler will consist of an egg transport and an energy propulsion system. These may be separate or combined into a single unit. The entire Scrambler device, **including the egg**, must fit into a 1.000 m cube when in the ready to launch configuration. If the egg transport is placed diagonally to fit in the cube, it must be launched from that position.
- b) All energy used to propel the egg transport must come from a falling mass not to exceed **2.000 kg at Regionals, 1.000 kg at States and 0.5000 kg at Nationals**. The mass may be part of the propulsion system and need not travel with the egg transport. Any part of the device whose potential gravitational energy decreases after the falling mass is released is considered to be part of the falling mass. The judges will measure the mass. The mass must be quickly and easily removed for measuring. It is suggested the device be impounded with the mass already detached. The uppermost part of the falling mass may not be higher than 1.000 meter from the floor when released.
- c) Energy from the falling mass may be transferred to other energy storage devices but they must be in their lowest energy state prior to releasing the mass. Additional sources of mechanical energy may be used to stop the device. The Scrambler may not contain any electrical/electronic devices.
- d) The egg transport should be designed to travel any distance from 8.000-12.000 meters as quickly as possible without leaving a 2.000 meter wide lane and come to a complete stop with the egg as close to the terminal barrier as possible. The stopping mechanism must be contained completely within the egg transport and work automatically. The egg transport may not be remotely controlled or tethered in any way to guide it or to make it stop.
- e) The egg transport must have a rigidly attached mount with a flat backstop for the egg. The backstop and bottom surface that the egg rests on must rigid and unpadded. **The backstop may be built of any rigid material, but it MUST have a minimum flat surface of 3.0 cm long by 3.0 cm high by 0.635 cm (0.25") wide.**
- f) An uncooked grade A large chicken egg (1 per team - provided by the judges) must be mounted with the bottom of the egg 5.0-15.0 cm above the floor, the rounded end of the egg resting against the rigid backstop and the "pointed" end of the egg extending at least 2.0 cm in front of the foremost part of the transport. Tape will be provided to secure the egg to the transport if needed, however no tape may be placed on the front 2.0 cm of the egg.
- g) If used, sighting/aligning devices must be attached to the Scrambler and remain installed during a run.
- h) Substances that may damage the floor or interfere with subsequent runs may not be applied to the wheels or floor.

### 2. **THE COMPETITION**

- a) The entire Scrambler system must be impounded before the start of the event and will be released from impound when the team has finished competing. Appeals by teams will not be processed after they remove their device from impound unless it has been released by the appeals committee.

- b) Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials or communication until they are finished competing.
- c) The competition will be on a straight and level 2-meter wide lane on a relatively smooth, hard, low-friction surface (e.g., hardwood, tile, stone) with a terminal barrier extending completely across its end. The terminal barrier will be located at a randomly chosen distance 8-12 m from the starting line (in whole meter intervals for regional, half meter intervals for state and the tenth meter intervals for the national tournaments).
- d) Teams will be given a total of 10 minutes to make up to 2 runs with their device. They may not back up the transport device on or near the track to set the distance into the stopping mechanism. During this 10-minute period teams may adjust their device, but they may not increase the falling mass once it has been measured. If the device cannot start at least one run within the 10-minute period, the team will receive participation point(s) only. A run may be completed if the mass has been released before the 10 minutes expires.
- e) The pointed tip of the egg will be placed even with the starting line anywhere along its length prior to the beginning of each run. All parts of the Scrambler and egg must be behind the starting line and within the 2-meter wide lane when the mass is released.
- f) The contestants may hold and release either the egg transport or the falling mass to start the run. They may not hold both. The mass and device may not be pushed or pulled to start it. All energy must come from the falling mass.
- g) The Run Time begins when the falling mass is released and ends when the egg transport comes to a complete stop.
- h) Once the falling mass has been released, the egg transport may not be touched until it has come to a complete stop. Contestants may not guide the egg transport in any way once the falling mass has been released.
- i) The transport should finish as close as possible to the terminal barrier without leaving the 2-meter lane. The Stopping Distance will be measured between the barrier and the point on the egg closest to the barrier, perpendicular to the plane of the terminal barrier. The time for judges to measure the Stopping Distance will not be included in the 10 minutes.
- j) If the egg is broken (as defined by cracking the egg enough to leave a wet spot on a paper towel) on the first run, a second run will not be permitted.

#### SCORING:

- k) The Performance Value for each run will be  

$$\text{Performance Value} = [3 \times \text{Run Time (in seconds)} + \text{Stopping Distance (in cm)}]$$
- l) Teams will be ranked using the single run that will give them the best overall place. The team with the run with the lowest Performance Value and no penalties will receive 1<sup>st</sup> place.
- m) **Devices that meet all the "CONSTRUCTION" requirements, but have a best run that meets any of the penalty conditions below will be ranked by their Performance Value in a series of second tiers after all runs that do not meet any of these conditions. Each violation will result in a lower ranking.**
  - i) The egg is broken (as defined by cracking the egg enough to leave a wet spot on a paper towel)
  - ii) Any part of the egg transport (other than the egg) makes contact with the barrier.
  - iii) Any part of the egg transport runs outside of the lane at any point of the run.
  - iv) The device doesn't travel at least ½ the chosen track distance.
  - v) Any rule under "CONSTRUCTION" or "THE COMPETITION" that does not have a specific penalty is violated.
- n) **Devices that do NOT meet all the "CONSTRUCTION" requirements will be ranked next, with each violation resulting in a lower ranking.**

See: <http://www.soinc.org/events/scrambler/>

## SOUNDS OF MUSIC

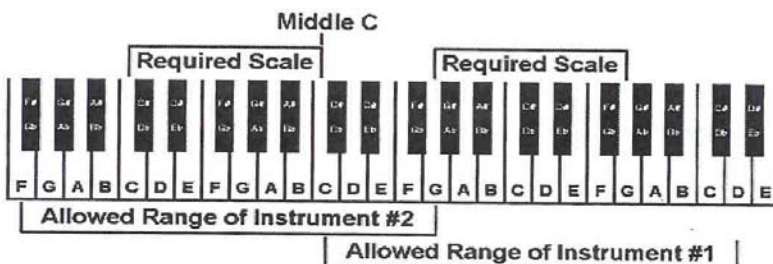
**DESCRIPTION:** Prior to the competition each team will build two types of musical instruments (woodwind, percussion, etc.) based on a 12 tone tempered scale, prepare to describe the principles behind their operation and be **able to** perform a major scale, a required melody and a chosen melody.

**EVENT PARAMETERS:** Teams must provide a score of all music to be performed and submit it in notated form at the beginning of their presentation. All music submitted must be written in the appropriate clef for their musical instruments. Each member will play at least one instrument.

**THE COMPETITION:**    **A TEAM OF: 2**    **APPROXIMATE TIME:** 30 20 min/Set-up 5 min

1. Each team member must play the required scale as given in the following chart and will be evaluated on range, pitch, and sound quality. However, to help teams select music and to improve their overall score they may wish to include notes within the maximum allowable scoring range.

<u>Scale</u>	<u>Instrument 1</u>	<u>Instrument 2</u>
Mandatory Scale	G major (G4 to G5)	C major (C3 to C4)
Allowable Scoring Range	C4 to D6	F2 to G4
Music submitted in	Treble Clef	Bass Clef



Members will also be asked to play any note from the required scale and the judge will **determine its accuracy**. ~~Test its accuracy with an electronic tuner.~~ No electric or electronic devices, toy or professional instruments or parts of such instruments will be permitted including items such as bells, whistles, mouthpieces, reeds, audio-oscillators, **resin**, **tuning pegs**, etc. The only exception to this exclusion is that strings (instrument or others) of any type are permitted. No electricity may be used. The students while playing the instruments must generate all energy.

2. Instruments will also be evaluated on creativity and originality, variety and workmanship.
3. The students will be asked to describe the principles behind the device and its construction (e.g., How does it make a sound? What determines the pitch of a note? How is volume changed?). This may be done through an oral interview and/or through a written set of questions. Questions about design and construction may also be asked of the team. Students must be able to define or explain basic terminology regarding sound, sound production, and related science terms. These include but are not limited to fundamental elements of wave theory, Bernoulli Effect, acoustics, musical sound perception, and harmonics. No notes, calculators, books, etc. will be allowed.
4. The team will then perform, in any key within the musical ranges specified, the lines of music included on the next page. The piece will be played as a duet **including melody and harmony**. Each instrument must be capable of playing the required lines as written or as transposed into a key adapted to their instrument but staying within the maximum allowable scoring range. They will also play a duet of their choosing which best shows the capabilities of their instruments. Students will be given a maximum of four (4) minutes to play both the required duet and the chosen duet.

- SCORING:** All teams will be ranked by the following tiers:
5. All teams that follow all the rules.
  2. Teams that do not write their music in the appropriate clefs.
  3. Teams that do not have music for the judges.
  4. Teams that play out of the given ranges (C4 to D6 and F2 to G4).
  5. Teams that use any prohibited devices.

It is important that all scoring is done by the same set of judges (preferably 2-3). If more than one person is judging, the average of all judges' scores will be the final score for the team. Judges should have knowledge of both music and the physics of sound.

1. Range of notes: quality of sound (22 points)
  - a) Demonstrated range \_\_\_\_ octaves (for instrument #1) \_\_\_\_ notes \_\_\_\_\_ Points (6)
  - b) Sound quality (compared to standard instruments #1) \_\_\_\_\_ Points (5)
  - c) Demonstrated range \_\_\_\_ octaves (for instrument #2) \_\_\_\_ notes \_\_\_\_\_ Points (6)
  - d) Sound quality (compared to standard instruments #2) \_\_\_\_\_ Points (5)
2. Creativity, variety, and workmanship of instruments (30 25points)
  - a) Originality/creativity (traditional/unusual) \_\_\_\_\_ Points (10)
  - b) Variety (percussion, wind, brass, string, other) \_\_\_\_\_ Points (10)
  - c) Workmanship (appearance, easy to play, durability, etc.) \_\_\_\_\_ Points (10)
3. Knowledge of theoretical basis of instruments (30 points) \_\_\_\_\_ Points (30)
 

Includes participation of both team members and an explanation of simple mathematical and physical principles of sound. It is suggested that this be done in an interview setting with approximately 4 to 6 pre-selected questions adaptable to various instruments.
4. Sound of the ensemble (20 25 points) Group Performance points for both required/chosen songs will be based on harmony, blend, technique, timbre, suitability of tune for instruments, rhythm, interpretation of music, etc.
  - a) Group Performance for the required song (10 points) \_\_\_\_\_ Points (10)
  - b) Group Performance for the chosen song (10 15 points) \_\_\_\_\_ Points (10 15)
5. **Bonus Points:** Each of the following will receive the specified bonus points.
  - a) Teams that follow all of the rules \_\_\_\_\_ Points (50)
  - b) Teams that furnish music for the judges with team name and number \_\_\_\_\_ Points (50)
  - c) Teams that write their music in the correct clefs and correctly notated \_\_\_\_\_ Points (50)
  - d) Teams that play all music in the correct range \_\_\_\_\_ Points (50)
  - e) Teams that use only allowed materials in building and playing \_\_\_\_\_ Points (50)

## The Ash Grove



### Required Song

*A* Suggested references: Musical Instrument Design by Bart Hopkin, See Sharp Press, 2000, \$18.95. Making Simple Musical Instruments by Bart Hopkin, Altamont Press, 1995, \$24.95. National Science Education Standards: / CONTENT STANDARD E: All students should develop abilities of technological design and understandings about science and technology.

## WRIGHT STUFF

1. **DESCRIPTION:** Prior to the tournament, participants will construct and test up to two rubber-powered model **monoplanes** airplanes to achieve maximum flight times. The event must occur inside and the room dimensions (approximate length, width and ceiling height) should be made available to teams in advance of the competition. Directors and supervisors are urged to minimize the effects of environmental factors such as air currents (e.g., doors, fans, etc.).

**A TEAM OF UP TO:** 2

**TIME:** time for the 1<sup>st</sup> flight plus 8 minutes

2. **CONSTRUCTION**

**IMPOUND:** No

- a) A rubber-motor-powered, propeller-driven airplane may be constructed from published plan(s), commercial kit and/or a student's design as long as the specifications below are satisfied: 1) Airplanes may not use solid balsa wings or tail assemblies. 2) Except for propeller assemblies, kits must not contain pre-assembled parts, pre-glued joints or pre-covered surfaces.
- b) Airplanes must be constructed only from wood, paper, plastic film covering and glue except for the Propeller Assembly, ~~ribbon assembly~~ and motor hooks. The major components (wing assembly, tail assembly, propeller assembly and motor stick) may be attached to each other using thread, music wire, malleable wire, paper or plastic tubes, and/or rubber bands. Plastic or rubber o-rings may be used to attach the motor to the airplane and propeller drive. Any dense material may be used for ballast.
- c) Total mass of the airplane throughout the flight, excluding the rubber motor, must be **7.0 8.0** grams or more.
- d) The airplane **must be a monoplane (one wing)** may use up to 2 wings (biplane), however the wings ~~must overlap vertically~~ and the horizontally projected wing span ~~of the assembled airplane must not exceed 40.0 50.0 cm. such that it will pass through uprights 40.0 cm apart.~~ The maximum wing chord (straight line distance from leading edge of wing to trailing edge, parallel to the fuselage) of ~~any single~~ the wing must be **7.0 10.0** cm or less. The maximum horizontally projected stabilizer span is ~~28.0 30.0~~ cm. **The maximum allowable chord of the stabilizes is 4.5 cm.**
- e) The Propeller Assembly may be built by the competitor(s) or purchased pre-assembled. It may include a propeller, a shaft, a hanger, and/or a thrust bearing. Bushings may be placed in the propeller or thrust bearing to reduce wobble or friction. The propeller must be a single two-bladed commercially made plastic propeller with a maximum diameter of 18.5 cm. Longer propellers may be trimmed to meet this specification. Trimming/shaving/twisting is also permitted to balance and/or reduce the mass of propeller or to change its pitch.
- f) A rubber motor not to exceed a mass of 2.0 grams (including any attachments such as o-rings) must power the airplanes and will be massed separately from the airplane. Motors may be lubricated before and/or after check-in. All qualified motors will be impounded after check-in and will be available to the teams only for official flights.
- g) The airplane(s) must be marked so that the judges can identify to which team they belong.

3. **THE COMPETITION:**

- a) Once teams enter the testing/flying area to compete, they may not leave the area or receive outside assistance, materials or communication until they are finished competing. Only competitors and judges will be allowed in the testing/flying areas. The event director shall have a separate designated area away from the competitors' area for coaches, parents, and other spectators. Any team violating this paragraph shall be disqualified.
- b) At the event supervisor's discretion, test flights may occur throughout the contest but will yield to any official flight. Before beginning their test flights, teams must have an official stamp or mark their log confirming it shows data for 10 previous flights. No test flights will occur in the last half-hour of the event. Multiple airplanes may test fly at once. A self-checking inspection station may be made available to students for checking their airplanes. The use of any type of winder is permitted.

- c) Each team must present a flight log of recorded data for at least 6 parameters for at least ten test flights prior to the competition. The three required parameters to be recorded are: 1) motor size before windup, 2) number of turns on the motor at launch, 3) flight time. The team may choose the 3 additional data parameters beyond those required, for example, turns remaining after landing, estimated/recorded peak flight height, estimated flight path diameter, the torque at launch, etc.
  - d) Teams will be given 8 minutes after their first official flight ends to prepare for and launch a second official flight with either their 1<sup>st</sup> or 2<sup>nd</sup> plane. Any flight beginning within the 8-minute period will be permitted to fly to completion. Participants may make adjustments to the airplane; however, time for such adjustments will be part of the 8-minute period. **Teams must elect to fly their second airplane (if available) if their first flight gets hung-up on an obstruction or is catastrophically damaged during the competition.** Teams will not be given extra time to recover or to repair their airplane.
  - e) Timing for each flight starts when the airplane leaves the student's hand and will stop when any part of the airplane touches the floor. If the model comes to rest on something other than the floor, another watch will be started. If the model comes free within ten seconds, timing continues. If not, timing ceases and ten seconds are deducted from the time for the official score. The timing official will measure and record the time aloft to the nearest tenth of a second for each flight. Steering the model is prohibited.
  - f) During the flight of one team's airplane, the event supervisor may permit other official flights **once** the prior airplane has started its descent. In the unlikely event of a collision, a team may elect a re-flight. The decision to re-fly may be made after their airplane lands. The eight-minute period does not apply to such flights.
  - g) ~~Bonus: At the State level, a 15-second bonus may be earned by having the airplane release a ribbon during the flight anytime after the first 15 seconds and before the airplane lands. At the National level, a 20-second bonus will be awarded if the ribbon is released from 30-45 seconds into the flight. The ribbon size must be at least 1.0 cm wide X 10.0 cm long and readily seen. The ribbon and any parts to be released will not be included in the mass of the airplane nor in the mass of the motor.~~
    - i) State Tournaments Only: 10% of the flight time will be added to the total if the airplane is a pusher plane (Propeller is located somewhere behind the wing).
    - ii) National Tournament Only: 10% of the flight time will be added if the airplane is a canard design (stabilizer is located in front of the wing and the propeller is located behind the wing).
4. **SCORING:** The winner is the team with the longest flight time for either flight. Ties will be broken by the longest time of the other flight.
- a) Teams with incomplete flight logs will have **10% of the flight time** deducted from each flight.
  - b) Teams without flight logs will have 30% of the flight time deducted from each flight.
  - c) 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 the rules.

National Science Education Standard: Content Standard E: All students should develop abilities of technological design and understandings about science and technology.

See: <http://www.soinc.org/events/wrightstuff/> for additional information

**THIS EVENT IS SPONSORED BY MIDWEST PRODUCTS CO.**

## WRITE IT/DO IT

### DESCRIPTION:

Technical writing skills are an important part of an engineer's or a scientist's abilities to communicate precisely and clearly. This event will test a competitor's ability to effectively communicate with a colleague in writing by having their partner construct a device from this written description.

**A TEAM OF:** 2

**APPROXIMATE TIME:** 55 Minutes

### THE COMPETITION:

1. A student is shown an object (which may be abstract) built from, but not limited to, such items as science materials, inexpensive materials (e.g., straw, push pins, Styrofoam balls, paper cups, Popsicle sticks, etc.) or commercial sets (e.g., K'nex, Googplex, Tinker Toys, Lego, Lincoln Logs, etc.).
2. 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 words and numerals 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.
3. 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.
4. Supervisors will attempt to use different materials than the materials that were used last year.

### SCORING:

The team, which builds the object nearest to the original and has properly written instructions, is declared the winner. Any improper use of symbols or codes (including use of words or letters as codes) will result in the team being ranked below other teams **and receive participation points only**. A point will be given for each piece of material placed in the proper connection and location compared to the model. 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. Time for the construction phase will be used as a tiebreaker.

**National Science Education Standard p 170 Content Standard G: Science as a human endeavor**  
"Some scientists work in teams and some work alone, but all communicate extensively with others"