

Science Olympiad

Division A

Saturday, March 9, 2024

Updated 09/26/23



**SAN JOAQUIN COUNTY
OFFICE OF EDUCATION**

Science Olympiad Division A

2024 Events

A is for Anatomy
Barge Building
Boggle Science
Can Race
Chopper Challenge
Color Wheel
Deep Blue Sea
Dynamic Planet
Fossils
How Big Can It grow?

“Knock Knock- Who’s
There?”
Metric Mastery
Mystery Architecture
Optics
Paddle Boat
Save the Ice
Simple Machines
Solar System
Water Rockets
Write It/Do It

Please note that these events and their guidelines may change. Head coaches will receive email updates as they are available.

If you have any questions, please contact: Student Events 209-468-4866

The health, safety, and wellbeing of students, staff, and our communities remain top priorities of the San Joaquin County Office of Education (SJCCE) during the COVID-19 pandemic. The SJCCE works closely with our public health experts and will keep you informed should activities and events need to be modified, canceled, or postponed. This may include a change in dates, times, locations, and delivery methods (in-person vs. virtual).

Study/Build/Do and Sections 2024

Study

Build

Do

A is for Anatomy	Barge Building	Boggle Science
Deep Blue Sea	Can Race	Color Wheel
Dynamic Planet	Chopper Challenge	Fossils
Knock Knock-Who's There?	How Big Can it Grow?	Metric Mastery
Optics	Paddle Boat	Mystery Architecture
Simple Machines	Water Rockets	Save the Ice
Solar System		Write It/Do It

Sections

(Don't put same student in two events listed in same section)

A is for Anatomy Barge Building Fossils Boggle Science	Paddle Boats Dynamic Planet Color Wheel Knock Knock	Chopper Challenge Deep Blue Sea Simple Machines Save the Ice	Solar System Metric Mastery Can Race Write It/Do It	How Big Can it Grow? Mystery Architecture Optics Water Rockets
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Event: A is for Anatomy

Description: This event will test students on their knowledge of both structure and function of the following systems: Nervous, Endocrine, Sense Organs.

A Team Of Up To: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: Each team may bring in only **one** 8.5 X 11" two sided page of information, in any form, from any source.

Event Managers: Event Managers will provide writing instruments.

The Competition: The test may include various formats such as: slides, stations, written answers, scantrons, multiple choice, etc. Students should be familiar with the **identified systems:**

Nervous

Endocrine

Sense Organs

Scoring: Each team will be given one answer sheet or scantron. High score wins, selected tie breaker questions and/or quality of free-response answers will be used to break ties. Selected tie breaker questions will be identified for students.

Possible Question/Station:

- What are the main functions of the nervous system?
- What are the sense organs and their functions?

Resources/Notes from EM:

Fourth, Fifth and Sixth Grade Science and Health Books

B/C connection: Anatomy and Physiology



Event: Barge Building

Description: Teams will construct a barge using aluminum foil that can support a cargo of the largest number of objects without getting them wet. The cargo isn't announced until impound.

A Team Of Up To: 2 **Approximate Time:** 20 min **Impound:** YES/estimation **Visitors:** YES

Teams: Must go to impound to make their estimation on the number of "cargo" their barge will hold. Teams may bring their own calculator for estimation. The impound estimation is closed, meaning only students are allowed in the estimating room/area.

Event Managers: Will provide foil (brand not to be announced), water and cargo, writing instruments and score sheets.

The Competition:

1. Each team of two students will report to impound to estimate the number of "cargo" their barge will hold. Before students estimating, the event manager will give the average weight of each cargo piece.
2. Cargo pieces may be pennies, washers, paper clips, marbles, or other similar objects. The cargo will not be known until the time of competition immediately before estimation impound.
3. Each team will be given a 15 x 15 cm piece of aluminum foil.
4. Each team will be given 10 minutes to construct their barges and turn them into the supervisor. No other materials may be used in building the barge.
5. Each team will then be given 5 minutes to load their barges.
6. The piece that caused the barge to sink will not count in the total cargo. Sinking occurs when water enters the barge.
7. Each piece of cargo must be loaded one at a time while the barge is floating in pan/container of water.

Scoring:

1. The winner will be the team with the highest score.
2. The score will be determined by the following formula: # (of cargo held) x 10 – the difference between predicted amount and actual amount.
3. Example:
If a team predicts their barge will hold 70 and it sinks at 57, their score will be:
 $57 \times 10 - 13 = 557$
4. Ties will be broken by accuracy of the prediction.
5. If the event manager determines that a contestant intentionally sinks his boat at or near the predicted number, that team will be disqualified and receive participation points only.



Event: Boggle Science

Description: Teams of 2 students will attempt to locate science words pertaining to a particular category on a board of 16 letters.

A Team Of Up To: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: No resources will be allowed.

Event Managers: Will supply the writing instruments, game boards and any other materials needed.

The Competition:

1. Teams will be given a board of 16 letters arranged in a 4 x 4 square pattern and a category. All teams will receive the same boards and the same categories.
2. The majority of words will be taken from **2015 Science Bowl topics**.
3. 5 minutes will be given for teams to locate words pertaining to the given category on a specific board of letters. Boards will contain 3-9 words each.
4. To make a word, students will start with a letter and each succeeding letter in the words must touch the previous letter in the same way (share a side OR touch corners.) No letter square may be used more than once in a single word. Abbreviations, contractions, hyphenated words and foreign words not found in an English dictionary are not acceptable. Singular and plural forms of a word count as the same word (i.e. CAR and CARS count as the same word, but CARS is worth more points due to extra letter.
5. Numbers given next to the letter in each box will be used to identify the first and last letter of the word (see sample below.)

Scoring: Five points will be awarded for each word. An additional point will be awarded for each letter in each word. Ties will be broken by number of words, then by the longest words.

Sample:

Category: Things with wheels

Team board:

Team card:

CARS
1 14
PLANE
9 8
BIKE
15 8

₁ C	₂ G	₃ N	₄ Y
₅ L	₆ A	₇ H	₈ E
₉ P	₁₀ R	₁₁ U	₁₂ K
₁₃ W	₁₄ S	₁₅ B	₁₆ I

5 X 3 words = 15 points (cars, plane, bike)
1 X 13 letters = 13 points (C,A,R,S,P,L,A,N,E,B,I,K,E)



Science Bowl Topics
A2 Science Olympiad

Earth Science

Earth's Surface

Water Weather

Earth's Resources

Ecosystems

Life Science

Human Body

Cell Biology

Genetics and Evolution

Structure and Function of Plants and Animals

Physical Science

Properties and States of Matter

Motion and Force

Sound and Light

Periodic Table

Chemical Reactions

Other

Math

Astronomy

Technology

Current Topics



Event: Can Race

Description: A team must design, build and test a race can to travel a specific distance as quickly as possible and as straight as possible.

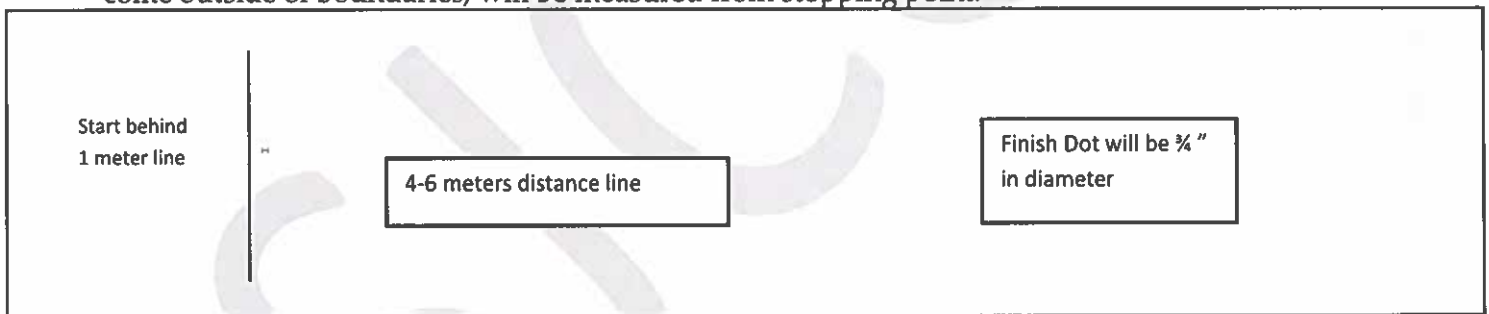
A Team Of Up To: 2 **Approximate Time:** 5 min **Impound:** YES **Visitors:** YES
Teams: Teams must impound their race can device and repair kit. Teams must also impound their test data, if teams chose to use their testing data. No other resources are allowed.
Event Managers: Will supply the track and timers and boundaries.

The Construction:

1. Race cans may use any size can. Racer surfaces may not be modified by addition of any substance.
2. Lollipop, Popsicle or other similar sticks may be used as the running arm. Tape and washers may be used.
3. Race cans should be designed to travel between 4-6 meters and come to a complete stop as close as possible to a finish dot.

The Competition:

1. The exact distance (between 4-6 meters) will be chosen by the Event Manager and be made known only after all race cans have been impounded.
2. Race cans will be released by contestants without any assisting push and must not be touched by anyone until the distance has been measured. Those race cans that stop from hitting an obstacle or come outside of boundaries, will be measured from stopping point.



3. The event manager will use 1 inch tape to define the one meter starting line, and the distance line. The boundaries will be at least 3 meters wide and 15 meters long and defined by cones and/or tape.
4. Teams have 4 minutes to do two runs. Each run will be measured and timed for a Score.
5. The best out of the two runs will be counted as the Final Score.
6. Teams may adjust their race can before each run. Teams may not roll the vehicle on or adjacent to the track surface between the start and finish dot. No practicing.

Scoring:

1. Low score wins. Scores are determined by **Distance score + Timed score = Final Score**
2. **Timed score** will be determined by taking the middle time from three timers
3. **Distance** will be measured from center-top of can to the Finish Dot.

Resources/Notes from EM

B/C connection: *Wheeled Vehicle*



Event: Chopper Challenge

Description: Contestants will build and test 2 choppers using only the materials provided at the competition.

A Team Of Up To: 1-2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** YES

Teams: Teams may bring pencils, a ruler/straight edge and scissors. No other equipment/supplies are allowed. *Each student is also required to turn in their own journal, documenting trials, errors, photos, lessons learned, etc. in the process of building device.*

Event Managers: Will provide paper and paper clips.

Construction:

1. Each team will be given one 8.5 X 11" sheet of copy paper, one 8.5 X 11" sheet of cardstock paper and three paper clips to construct 2 choppers that use rotation to slow their descent.
2. Each chopper must be made using only the paper and paper clips provided by the event manager.
3. The choppers need not be the same size and shape.
4. Teams are allowed to have left over paper and/or paper clips.
5. Teams will be given 20 minutes to construct both choppers.

The Competition:

1. When it is their turn, contestants will drop each of their choppers, one at a time, from the height specified by the judges. All teams will release their choppers from the same height. Height will be determined by the event manager and will be between 2-6 meters.
2. The judges will record the time it takes for each chopper to reach the ground/floor. Time will continue if the chopper bounces off an object, but will stop if the chopper gets stuck and stops.
3. This event may be held outdoors.

Scoring:

1. The team's score will be the sum of the flight times for both choppers. Longest total time wins.
2. Ties will be broken by comparing each team's single longest flight times.

Resources:

B/C connection: Helicopters



Event: Color Wheel

Description:

Each student will use tempera paint to make secondary and tertiary colors on the color wheel.

Number of Participants: 2 Approximate Time: 45 minutes Visitors: NO

Competition:

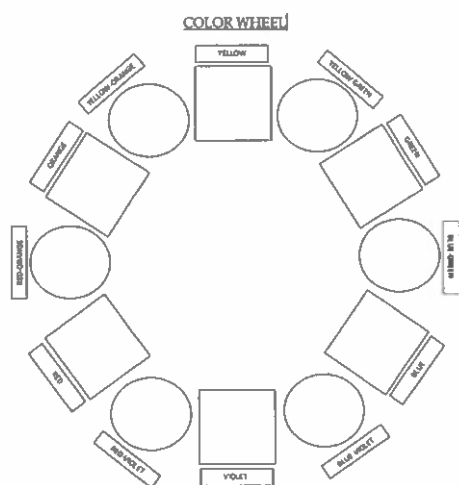
1. Students will be given a blank color wheel for their template as well as a color wheel for their reference.
2. Paint, paintbrush, water cup and paper towels will be provided.
3. ONLY Red, Yellow and Blue paint will be made available for participants to create their color wheel.
4. Students will mix their primary colors to accurately replicate the color wheel sample given.

Scoring:

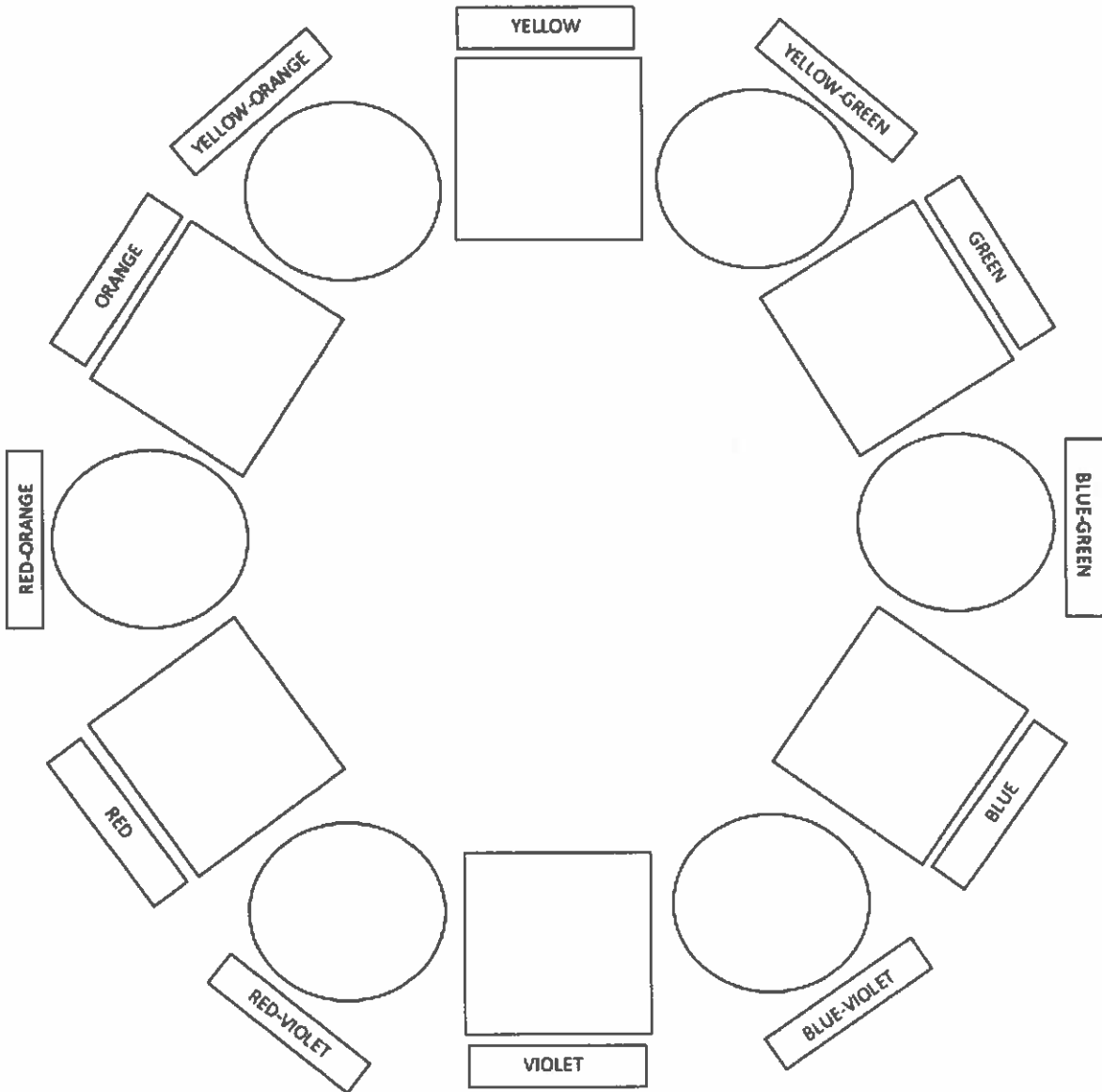
The scoring of the event will be based on the accuracy of their paint matching to the color wheel sample.

- 2 points for exact match
- 1 point for close match/attempt
- 0 points for non attempt or wrong color

TIEBREAKER: Based on fastest time completed with closest color accuracy.



COLOR WHEEL



Event: Deep Blue Sea

Description: This event will test students' knowledge about oceanography.

A Team Of Up To: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: Must bring in a sharpened #2 pencil and backup pencil. Teams may bring in one 8.5 X 11" two sided page of information, in any form, handwritten or typed.

Event Managers: Will provide all necessary items, objects, materials, questions and response sheet for participants to complete stations.

The Competition: This event will be run in station format. Teams will rotate through stations with questions, models, pictures, diagrams, and maps that assess oceanography. Students may not go back to previous stations.

Topics may include but are not limited to:

- Physical and Chemical Properties of water, Ice and Saltwater
- Ocean flora (algae, kelp, etc.)
- Ocean fauna (mammals, mollusks, etc.)
- Ocean vessels and equipment used in exploring (diving bells, submersibles, diving gear, etc.)
- Physical features (trenches, seamounts, etc.)
- Phenomena (tidal waves, currents, wave characteristics, etc.)
- Geography (location and identification of oceans, seas, major bays, etc.)
- Vocabulary (relating to any of the above topics)

Scoring: High score wins. Points will be awarded for accuracy and quality of responses. Ties will be broken with predetermined questions and/or accuracy.

Possible Question/Station:

- Identify a picture of algae
- Match the definition to the word Pelagic Zone

Resources/Notes from EM:

- Have students practice taking timed tests
- Physiographic Map of Ocean Floor
- Oceanography Books
- On-line power points on oceanography topics
- Quizlet

B/C connection: Dynamic Planet



Dynamic Planet

Description: Students will learn about plate tectonics, earthquakes and volcanoes

A team of up to: 2 **Approximate time:** 50 min. **Impound:** No **Visitors:** No

Teams: Students may bring in one set of four 8.5" x 11" double-sided pages for the team with information from any source. Recommended that each participant bring in his/her own #2 pencil.

Event Manager: will provide all equipment, pictures, and diagrams needed.

The Competition:

Participants will be presented with one or more tasks requiring their knowledge and understanding of the Earth's earthquakes, volcanoes, and plate tectonics. Information includes but is not limited to:

1. Earthquakes- what causes earthquakes to occur
 2. Earthquake wave types, origin, and characteristics (body waves & surface waves). Use of earthquake waves (reflection, refraction, shadow zones) to determine interior structure of the Earth (crust, mantle, outer core, inner core)
 3. Earthquake measurements- intensity scale & magnitude scales, seismographs, seismograms, determination of epicenter (lag time)
 4. Effects of earthquakes including destruction, tsunami, landslides, fire, and liquefaction.
 5. Notable earthquakes including : Valdivia, Chile May 1960, Prince William Sound, Alaska March 1964, Sumatra, Indonesia 2004, Sendai, Japan March 2011, Kamchatka, Russia November 1952, San Francisco 1906, Loma Prieta 1989, 1700 Orphan Tsunami, 1556 Shaanxi Earthquake
- f. Plate tectonics- definition, what comprises a plate
- g. Development of the theory of plate tectonics - lines of evidence for plate tectonics (know continental drift evidence and problem why it was not accepted)
- h. Where the major plates are located and interaction between these plates Types of plate interaction at boundaries- divergent, transform, convergent, emphasis on Cascadia fault, Chili-Peru Trench, Mid-Atlantic Ridge, East Pacific Rise, San Andreas fault, Marianas trench, formation of Himalayas
- j. Land/ocean features associated with different types of plate boundary interactions including but not limited to subduction zones, spreading centers, mountains, rift valleys, trenches, hydrothermal vents, seamounts, faults, volcanic island and continental volcanic arcs
- k. Compressional forces vs. Tensional Forces
- l. Volcanoes -what causes volcanoes to erupt (decompression melting, flux melting, hot spots) Hot Spot: emphasis on Hawaiian- Emperor Chain, Yellowstone, Iceland, Long Valley
- m. Types of volcanoes
- n. Types of eruptions, VEI, Notable eruptions: Siberian Traps, Deccan Traps, Mt. Vesuvius 79 AD, Mt. St. Helen's 1980, Mt. Tambora 1815, Krakatoa 1883, Mt. Pelee 1902, Novarupta 1912, Crater Lake, Paracutin 1943, Toba -74,000 years ago
- o. Liquid part of eruption: magma, lava (aa, pahoehoe, pillow lava) composition (felsic, mafic, ultramafic)
- p. Gaseous part of eruption (what gases are most abundant)
- q. Solid part (tephra, pyroclastic) size of tephra (ash, cinder, lapilli, volcanic bomb, block),
- r. Intrusive vs. Extrusive: Crystal size as an indicator of cooling rate. Examples: obsidian, pumice, basalt, scoria, andesite, granite, gabbro, rhyolite.
Intrusive (plutonic) rock formations-batholith, stock, dike (vein), volcanic neck, laccolith, sill, lopolith)
- s. Volcanic features including but not limited to: lahar, nuee ardent, fumaroles, geysers, mud pots, craters, calderas, pillow lava, lava tube, Pele's tears, vents, seamounts, etc.

Representative tasks:

Given a diagram of a volcano, label the parts



Determine the distance from the epicenter given the lag time
Be able to describe the formation and characteristics of a tsunami

Scoring: High Score wins. Points will be awarded for the quality and accuracy of responses. Ties will be broken by the the accuracy and quality of answers to pre-selected questions

SUCOEF





FOSSILS

Event Details:

- a. **Description:** In this event, the Participants will identify and answer questions about fossils.
- b. **Number of Participants:** 2 students from each team
- c. **Event Time:** 50 minutes
- d. **Required Safety Equipment:** None
- e. **Allowed Resources:**
 - i. One (1) 8.5" x 11" sheet of paper with information on both sides from any source and in any format. Placing the sheet of paper in a sheet protector, or laminating it, is fine as long as the sheet protector is sealed by tape. There can be nothing attached to the sheet of paper.
 - ii. A pen or pencil for each Participant

Event Format:

- a. **Room Set-Up:** The room should be set-up with 10 to 15 stations where each station features between 6 and 8 questions about a particular fossil along with models, slides, pictures, or information that relates to fossils and helps the Participants answer the questions.
- b. **Provided Items:** The Event Supervisor will provide the models, slides, pictures, information, and questions found at each station as well as an answer sheet for Participants to record their answers.
- c. **Participant Actions:** Working quietly with their partner, the Participants will:
 - i. Start at the station assigned by the Event Supervisor and answer the questions located there.
 - ii. Have between 3 and 5 minutes, depending upon the number of stations, to analyze the information provided and answer the questions asked.
 - iii. Rotate to a new station designated by the Event Supervisor and answer the questions found there, upon a signal from the Event Supervisor.
 - iv. Leave the station as they found it when they rotate to a new station.
 - v. Not be able to return to any stations after they rotate to another station.

Event Content:

- a. For this event, Participants need to learn about the following fossils:
 - i. Brachiopod
 - ii. Crinoid ("Sea Lily")
 - iii. Ammonite
 - iv. Bivalve (clam, scallop, or oyster)
 - v. Horn Coral
 - vi. Bryozoan
 - vii. Echinoid (sand dollar, sea urchin)
 - viii. Fossil Fern
 - ix. Stromatolite
 - x. Gastropod (snail)
 - xi. Bony Fish
 - xii. Cartilaginous Fish (shark)
 - xiii. Mosasaur (sea reptile)
 - xiv. Pterosaur (flying reptile)
 - xv. Mammal-like Reptile (Dimetrodon)
 - xvi. Dinosaur (Tyrannosaurus)
 - xvii. Dinosaur (Apatosaurus)
 - xviii. Dinosaur (Triceratops)
 - xix. Dinosaur (Parasaurolophus)
 - xx. Bird (Archaeopteryx)
 - xxi. Mammal (Saber Toothed Cat)
 - xxii. Mammal (Mammoth)
 - xxiii. Mammal (Mastodon)
 - xxiv. Mammal (Horse)
 - xxv. Trace Fossil (Footprint)
 - xxvi. Trace Fossil (Coprolite)
 - xxvii. Other Material: Amber
 - xxviii. Other Material: Petrified Wood



- b. For each fossil, Participants will need to know:
- The identity of the fossil, its appearance, and characteristics of the Group to which it belongs
 - The type of rock in which the fossil is preserved
 - The time period or range in years when fossil lived
 - What the fossil tells us about the animal or plant from which it was created
 - How the fossil lived
 - Attached to sea floor
 - Crawled/walked on the bottom of sea floor
 - Lived in mud
 - Swam in oceans/seas
 - Walked on land
 - Flew in the air
 - Grew in forests
 - How the fossil formed
 - Cast
 - Mold
 - Imprint
 - Mineral replacement/petrified
 - Trapped in amber
 - Environment fossil lived in
 - Ocean
 - Land
 - Swamp
 - Lake
 - If the fossil is of an animal, how did it obtain food:
 - Predator
 - Herbivore
 - Filter feeder
 - Scavenger

Event Scoring:

- Participants will be awarded points for each correct answer they provide
- The highest number of points wins
- The following will be used as Tiebreakers:
 - Correct spelling of the answers
 - Select questions identified at the start of the event
- Teams found to have repeatedly left stations messy or have damaged items provided at the discretion of the Event Supervisor, may have up to 20% of their score deducted as a penalty.



HOW BIG CAN IT GROW?

Event Details:

- a. **Description:** In this event, the Participants will grow two carrots from seed and bring them unpicked to the tournament to have them measured, along with data collected during the planting and growing phases.
- b. **Number of Participants:** 2 students from each team
- c. **Event Time:** 15 minutes
- d. **Required Safety Equipment:** None
- e. **Allowed Resources:** None

Event Format:

- a. **Room Set-Up:**
 - i. The room should be set-up with 2 to 3 stations, depending upon the numbers of teams at the tournament. Each station will have the needed materials for the Participants to pick the carrot and have the Event Supervisor conduct measurements.
- b. **Provided Items:** The Event Supervisor will provide a device to measure the weight of the carrots as well as a device to measure both the length and circumference of the carrots.
- c. **Participant Actions:** Working together, the Participants will:
 - i. Decide on a method for growing carrots before the tournament, along with the type of carrot to grow. Make sure there is sufficient lead time to allow carrots to grow.
 - ii. Plant and grow their carrots, collecting and recording data about the amount of water provided, soil temperature, hours of sunlight, amount of fertilizer, or any other observations that helped to inform the germination and growing process.
 - iii. Report at their assigned time to submit their unpicked carrots and data log to the Event Supervisor, at the tournament.
 - iv. Pick their carrots and observe as the Event Supervisor measures the carrots mass, length, and circumference at the widest point.

Event Content:

- a. For this event, Participants need to learn about the following topics:
 - i. Indoor growing techniques (i.e., horticulture)
 - ii. Varieties and growing behavior of carrots
- b. For this event, Participants will need to decide upon how they are going to grow their carrots from seed in time for the tournament, as well as what variety of carrot they should grow.

Event Scoring:

- a. Participants will be awarded points based on the average measurements of their two carrots.
 - i. Average Carrot Length x 100 points



- ii. Average Carrot Mass x 100 points
- iii. Average Carrot Circumference at the Widest Point x 40 Points
- iv. Log Score = 1 point for every data entry recorded each day (see 2.c.ii.)
 - 1. Maximum of 3 points can be awarded per day
 - 2. The Total Log Score Maximum that can be earned is 270 points
- b. The highest number of total points wins
- c. The following will be used as Tiebreakers:
 - i. Longest individual carrot
 - ii. Heaviest individual carrot
- d. Teams found to have repeatedly left stations messy or have damaged items provided at the discretion of the Event Supervisor, may have up to 20% of their score deducted as a penalty.



Event: “Knock, Knock- Who’s There?”

Description:

This event is designed to examine a student's knowledge and awareness of his fellow travelers on the planet earth. Contestants will be asked to identify a variety of naturally occurring evidence that indicates the presence of, the passage of, or the existence of some living organism in the Northern California environment.

Number of Participants: 1-2 Approximate Time: 40 minutes Visitors: NO

Competition:

Each team may bring one, 2-3 inch, 3-ring binder containing hole-punched pages of information in any form from any source.

1. The competition may be administered in any of the following formats or combination:

- Orally - slides/illustrations may be projected and questions asked. Each question will be stated twice.
- Actual examples will be placed on display for identification and/or questions.

2. The majority of questions will require a multiple-choice answer or a short answer.

Scoring:

Each correct answer will be worth one point. Certain specimens or examples will be designated as tiebreakers. A second tiebreaker would be misspelled terminology.

Sample specimens that might be used include:

Animal tracks	Skulls
Animal skins	Fossils
Shed from molting	Predator damage
Cocoons	Plant damage
Feathers	Sounds
Egg cases	Scat
Animal houses(wasp,nest,etc)	



Event: Metric Mastery

Description: Teams will demonstrate their understanding of metric measurement by estimating and measuring length (meter), mass (gram), fluid volume (liter), angles, and temperature (Celsius). Teams should also be able to create and interpret data tables, bar graphs, line graphs, pie charts, and pictographs and make basic calculations that include time, money, fractions and percentage.

A Team Of Up To: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: Each team may bring in only one 8.5 X 11" two sided page of information, in any form, from any source.

Event Managers: Event Managers will provide writing instruments. EMs will also provide graphs to be analyzed, rulers, calculators, protractors, meter tapes, meter sticks, balances of any kind, beakers, graduated cylinders, thermometers, objects to measure.

The Competition:

This event will be run in a station format. Teams will rotate through stations that assess any or all of the following topics:

- a. Estimate or measure the angle degree, mass, volume, length, area, or temperature of various objects in metric units to the precision requested.
- b. Understand relative scale of metric units and which is appropriate for measurement (mg, g, kg, mm, cm, m, km, mL, L, kL, oC, oK, cm², cm³) in different scenarios.
- c. Collect data (e.g. number of water drops various coins can hold) and represent that data in a correctly labeled graph or data table.
- d. Plot data points, make and interpret data tables, draw and interpret graphs, including what trends can be predicted from the data shown.
- e. Make estimates of data between or beyond the data points given.
- f. Draw and identify lines and angles, and classify shapes by properties of their lines and angles.
- g. Calculate the amount of time between two events (No time zone calculations).
- h. Calculate fractions or percentages based on charts, tables or data.
- i. Solve problems that involve the use of money.

Scoring:

Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to selected questions chosen by the event leader prior to competition.

Resources/Notes from EM:

<http://teachers.net/lessons/posts/1275.html>
<http://sciencespot.net/Pages/classmetric.html>
http://www.mathgoodies.com/lessons/graphs/bar_graph.html



Event: Mystery Architecture

Description: Students will be given a bag of materials to build a freestanding tower as high as they can. The tower should be constructed to support a ping pong ball at its top.

A Team Of Up To: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: May bring in scissors and a ruler to use as tools while building the tower. No other resources are allowed.

Event Managers: Will supply a bag for each team. Each team will receive exactly the same materials. Materials are unknown until the competition.

The Competition:

1. Students will have 20 minutes to construct a tower to support a ping pong ball at its highest point. The top of the ping pong ball must be higher than any part of the structure.
2. Only those materials supplied in the bag, and the bag itself, may be used to construct the tower. No other materials or adhesives may be part of the finished tower.
3. Examples of materials that may be provided include, but are not limited to: straight pins, paper cups, drinking straws, paper clips, tape, string, paper, etc.
4. Each team may bring their own ping pong ball to use while building their tower, however, all towers will be measured using the same ping pong ball provided by event manager.
5. The students are to inform the judges when they finish their tower. They will place the ping pong ball provided by the event supervisor on the top of their tower. The tower must remain standing long enough for the height and base to be measured.
6. The tower must be free standing. It cannot be attached to the tabletop, floor, wall or ceiling.

Scoring:

1. The height of the tower and width of its base will be measured as precisely as possible by the judges. Since no building materials are to extend above the ping pong ball, the ping pong ball will be considered the highest point of the tower. The width of the tower will be measured at its base. The largest diameter of the base will be recorded.
2. All towers that support the ping pong ball will be ranked above those that do not.
3. The towers in each group will be ranked according to their height. Tallest tower first, the shortest tower last.
4. In the event of a tie, the winner will be the tower with the smallest base measurement.

B/C connection: Mystery Architecture





OPTICS

Event Details:

- a. **Description:** In this event, the Participants will answer questions and complete small tasks about the light and its properties.
- b. **Number of Participants:** 2 students from each team
- c. **Event Time:** 30 minutes
- d. **Required Safety Equipment:** None
- e. **Allowed Resources:** A pen or pencil for each Participant

Event Format:

- a. **Room Set-Up:** The room should be set-up with 10 to 15 stations where each station features between 6 and 8 questions about light or one small activity associated with light (i.e., creating a color, splitting light with a prism, reflecting light around a barrier) for the team to complete or analyze.
- b. **Provided Items:** The Event Supervisor will provide the models, slides, pictures, information, and questions found at each station as well as an answer sheet for Participants to record their answers.
- c. **Participant Actions:** Working quietly with their partners, the Participants will:
 - i. Start at the station assigned by the Event Supervisor and answer the questions located there.
 - ii. Have between 2 and 3 minutes, depending upon the number of stations, to analyze the information provided and answer the questions asked or complete the task.
 - iii. Rotate to a new station designated by the Event Supervisor, upon a signal from the Event Supervisor, and answer the questions found there.
 - iv. Leave the station as they found it when they rotate to a new station.
 - v. Not be able to return to any stations after they rotate to another station.

Event Content:

- a. For this event, Participants need to learn about the following concepts associated with light:
 - i. Electromagnetic Spectrum
 - ii. Wave Properties (i.e., Wavelength, Frequency, Speed, the Speed of Light, Energy)
 - iii. Visible Light (i.e., Transparent, Translucent, Opaque, Light Sources, Candles/Lumens Measurements)
 - iv. Reflection and Refraction (i.e., Laws, Mirrors, Lenses)
 - v. Color (i.e., the Spectrum, Primary and Complementary Colors, Colored Materials)
- b. For this event, Participants may be expected to complete simple activities such as:
 - i. Bend a ray of light around an obstacle using mirrors
 - ii. Create complementary colors from primary colors
 - iii. Create a reflection using a concave or convex mirror
 - iv. Make a spectrum
 - v. Use filters to change the color of a light source





Event Scoring:

- a. Participants will be awarded points for each correct answer they provide or activity they complete
- b. The highest number of points wins
- c. The following will be used as Tiebreakers:
 - i. Correct spelling of the answers
 - ii. Select questions identified at the start of the event
- d. Teams found to have repeatedly left stations messy or have damaged items provided at the discretion of the Event Supervisor, may have up to 20% of their score deducted as a penalty.



Event: Paddle Boat

Description: In this event, teams will design, build, and bring to the competition a paddle boat whose main propulsion is produced by up to two #64 rubber bands (3.5" x .25")

Number of Participants: 1-2 **Impound:** Yes-during designated impound time. **Visitors:** YES

Test time (per team): 5 minutes (timing starts at the winding of rubber band)

Construction:

1. Each team will bring a homemade paddle boat to the competition. Each device should be designed and built by the students. Adult construction assistance is OK when using power equipment or sharp tools. No kits.
2. The final construction paddle boat must fit inside a 20cm by 10cm by 5cm box. (an assembled paddle can be dismantled from the assembled boat to fit within the box. Paddle cannot be disassembled).
3. The dimensions of the water trough are 20cm(width) x 3.66m(length)x 12.5cm (depth)
4. The only materials permitted in the design of the paddle boat are:
 - a. Any wood
 - b. Any glue
 - c. Nails
 - d. Two #64 rubber bands(supplied by the event supervisor)
 - e. Paint

The Competition:

1. Devices will be measured in impound to determine whether they meet construction requirements. They will remain in the impound area until the assigned race time.
2. Teams will be given two runs in the water trough. The better of the two runs will count as the official distance measurement. A maximum of five minutes will be given to complete the two runs. Adjustments will be allowed between the runs.
3. The rubber bands, which will be supplied at the time of the competition, must be installed at that time.
4. Each rubber band can be twisted no more that twenty times (One twist is defined as a 360 degree rotation of the rubber band. The paddle will have an X marked on one side to keep track of the rotations).
5. The competition will take place as follows:
 - a. The boat must stay in contact with the water at all times.
 - b. The boat will be released by the contestant from the designated starting position in the water.
 - c. The distance traveled shall be recorded in centimeters.
 - d. Contestants will not be able to touch the paddleboat once it is released in the water.

Scoring: The team that goes the farthest will be the winner. In the event of a tie, it will be the paddle boat that goes the farthest and has the fastest time.





SAVE THE ICE

Event Details:

- a. **Description:** In this event, the Participants will construct a container, from a variety of provided materials that will prevent an ice cube from melting.
- b. **Number of Participants:** 2 students from each team
- c. **Event Time:** 50 minutes – 15 minutes to construct the container, 30-minute wait, 5 minutes measuring the results
- d. **Required Safety Equipment:** None
- e. **Allowed Resources:** None

Event Format:

- a. **Room Set-Up:**
 - i. The room should be set up with a station for each team competing in that particular time block at the tournament. Each station will have the needed materials for the participants to participate in this event.
- b. **Provided Items:** The Event Supervisor will provide the following items for each team: masking tape, a "Sharpie" marker, ice cubes of the same approximate shape and size, small plastic "Ziploc" bag (i.e., Snack Size), insulating materials (i.e., Styrofoam cups, Styrofoam chips, metal cans, plastic cups, newspaper, and fabric scraps.) In addition, the Event Supervisor needs to provide equipment to measure the water released from the melting ice cube (i.e., 10 mL Graduated Cylinder, 30 mL Graduated Cylinder, electronic balance, paper towels).
- c. **Participant Actions:** Working together, the Participants will:
 - i. Place their ice cube in the provided "Ziploc" plastic bag.
 - ii. Construct an insulating container to limit the amount an ice cube melts over 30 minutes, using only the materials provided by the Event Supervisor.
 - iii. Seal the plastic bag containing the ice cube inside of their container and label it with their team name and number before their 15 minutes of construction time ends.
 - iv. Wait 30 minutes, then upon the Event Supervisor's instruction they will bring their container to the Event Supervisor to be measured.
 - v. Remove the plastic bag and its contents from the container after the entire assembly has been weighed by the Event Supervisor.
 - vi. Carefully remove the ice cube from the plastic bag and pour the accumulated water into the measuring device provided by the Event Supervisor.

Event Content:

- a. For this event, Participants need to learn about the following topics:
 - i. Basics of Thermodynamics (e.g., insulation, heat, energy, energy transfer)
 - ii. Basic Chemistry (e.g., States of Matter, Temperature, Material Properties, Conservation of Energy)
- b. For this event, Participants will need to practice using the engineering design process and a variety of materials to create an insulating container prior to attending the tournament.



Event Scoring:

- a. The lowest number of total points wins
- b. Participants will be awarded points based on:
 - i. the amount of water found in the plastic bag after 30 minutes x 50 points
 - ii. the total mass of the container x 50 points
- c. The Tiebreakers for this event will be the team with the lower efficiency rating for the container.
 - i. Amount of Water in the Bag/Total Mass of the Container Assembly
- d. Teams found to have repeatedly left stations messy or have damaged items provided at the discretion of the Event Supervisor may have up to 20% of their score added as a penalty.



Event: Simple Machines

Description:

Participants will be asked to identify, use and answer questions about simple machines.

Number of Participants: 2 Approximate Time: 45 minutes Visitors: NO

Competition:

Each participant will move from one station to another for up to 15 stations. Each station will contain a picture or example of a simple machine. The student will be asked to identify the machine and answer a question about it, or use equipment to measure some variable such as length, force or weight.

The Simple Machines used are:

1. Lever
2. Inclined Plane
3. Pulley
4. Screw
5. Wheel and Axle
6. Wedge

Students **MUST** move at the indicated time to ensure that all teams have equal opportunity to use the equipment at each station(2 minutes per station). Answer sheets will be provided for participants.

Scoring:

The scoring of the event will be based on the number of correct answers.

Sample Questions:

There is a drawing or a sample of a lever at a station. The student will be asked:

1. What simple machine is being used?
2. The point of support on this simple machine called _____?
3. What is the length of the effort arm in centimeters? _____

There is a setup of an inclined plane with a mass on it and a meter stick available.

1. What simple machine is being used?
2. Calculate a problem knowing that work equals force times distance.





SOLAR SYSTEM

Event Details:

- a. **Description:** In this event, the Participants will answer questions about the planets and objects of our Solar System along with other objects in the night sky.
- b. **Number of Participants:** 2 students from each team
- c. **Event Time:** 50 minutes
- d. **Required Safety Equipment:** None
- e. **Allowed Resources:**
 - i. One (1) 8.5" x 11" sheet of paper with information on both sides from any source and in any format. Placing the sheet of paper in a sheet protector, or laminating it, is fine as long as the sheet protector is sealed by tape. There can be nothing attached to the sheet of paper.
 - ii. A pen or pencil for each Participant

Event Format:

- a. **Room Set-Up:** The room should be set-up with 10 to 15 stations where each station features between 6 and 8 questions about a particular planet, object of our Solar System (i.e., asteroids, meteors, moons), or other objects in the night sky (i.e., constellations, the North Star) along with models, slides, pictures, or information that helps the Participants answer the questions.
- b. **Provided Items:** The Event Supervisor will provide the models, slides, pictures, information, and questions found at each station as well as an answer sheet for Participants to record their answers.
- c. **Participant Actions:** Working quietly with their partner, the Participants will:
 - i. Start at the station assigned by the Event Supervisor and answer the questions located there.
 - ii. Have between 3 and 5 minutes, depending upon the number of stations, to analyze the information provided and answer the questions asked.
 - iii. Rotate to a new station designated by the Event Supervisor and answer the questions found there, upon a signal from the Event Supervisor.
 - iv. Leave the station as they found it when they rotate to a new station
 - v. Not be able to return to any stations after they rotate to another station

Event Content:

- a. For this event, Participants need to learn about the following planets, objects of our Solar System, and night sky objects:

Planets

- i. Mercury
- ii. Venus
- iii. Earth
- iv. Mars
- v. Jupiter
- vi. Saturn
- vii. Uranus
- viii. Neptune

Solar System Objects

- ix. Pluto
- x. Earth's Moon (Luna)
- xi. The Sun (Sol)
- xii. Asteroid Belt
- xiii. Haley's Comet
- xiv. Comet Hale-Bopp
- xv. Meteors

Night Sky Objects

- xvi. Betelgeuse
- xvii. Orion
- xviii. Pleiades
- xix. Polaris
- xx. Proxima Centauri
- xxi. Sirius
- xxii. Ursa Major
- xxiii. Ursa Minor





- b. For each planet, object of our Solar System or the night sky, Participants will need to know:
 - i. The appearance in the night sky and how it changes across different time periods
 - ii. The makeup of the object (i.e., terrestrial vs. gaseous planets, key stars in a constellation, presence of moons or rings, number of moons)
 - iii. Relative size of the object, relative distances from Earth, and relative distance from other objects
 - iv. How objects move in the sky and how that movement and their interactions affects their appearance (i.e., eclipses, moon phases)

Event Scoring:

- a. Participants will be awarded points for each correct answer they provide
- b. The highest number of points wins
- c. The following will be used as Tiebreakers:
 - i. Correct spelling of the answers
 - ii. Select questions identified at the start of the event
- d. Teams found to have repeatedly left stations messy or have damaged items provided at the discretion of the Event Supervisor, may have up to 20% of their score deducted as a penalty.



Event: Water Rockets

Description: Prior to the competition, teams will construct (up to) two rockets designed to stay aloft for the greatest amount of time.

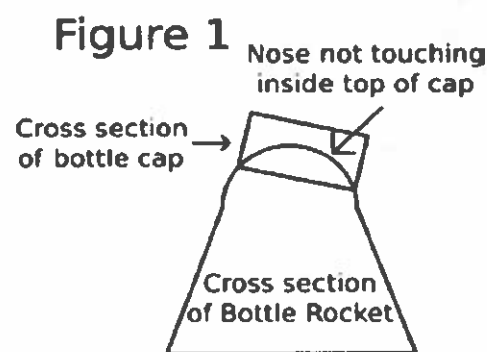
A Team Of: 2-3 **Approximate Time:** 10 min **Impound:** NO **Visitors:** YES

Teams: Must bring own eye protection. Students may bring repair kits containing tools, spare parts and extra parachutes. Teams from the same school may share a repair kit, but they may not share the same rocket or parachutes. Students should keep rockets labeled and stored with them in a safe container. Students will bring their rockets, repair kits and journals at assigned time. *Each student is also required to turn in their own journal, documenting trials, errors, photos, lessons learned in the process of building device.*

Event Managers: Will provide water rocket launcher, water and timers.

Construction:

1. Rockets must be made from a standard 2 liter soda bottle which is used to hold water and air pressure that propels the rocket when released. The structural integrity of the pressure vessel must not be altered in any way. This includes but is not limited to: physical, thermal, or chemical damage (holes, scratches, increasing the volume, restricting the bottle's opening, cutting, sanding, aluminum tape, using hot or super glues.) No glues of any type are allowed on the pressure vessel, but glue may be used on other parts of the rocket.
2. Only tape may be used to attach fins or other items to the pressure vessel. If the pressure vessel is covered in tape, paper or other material you may use glue to attach items to the covering as long as it doesn't distort or weaken the pressure vessel.
3. Commercially made rocket components, sharp/pointed objects, parts made from glass and metal are not allowed. (*Note: a small metal swivel may be used for the parachute attachment.*) No rigid plastics like PVC or ABS can be used in the front of the rocket.
4. The nose of the rocket must be rounded at the tip and designed such that when a standard 2-liter bottle cap is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1)
5. Event managers will assess the integrity of the pressure vessel by looking for discoloration, bubbles, thinning or cuts in the walls of bottle. Alteration to the structural integrity of the pressure vessel is a safety violation of the rocket and it must not be launched as this is a safety issue.
6. Fins, parachutes and other items may be added to the outside of the bottle to increase the time aloft.
7. No solid weights like batteries, fishing weights or hard rigid items can be used.
8. Energy to propel the rocket must come only from the water and air pressure in the bottle. Other sources of potential or kinetic energy are not allowed. Only plain tap water may be used in the rocket. No other materials of any type may be put in the bottle or added to the water. A water level line may be marked on the bottle to aid in adding water.
9. Parts of the rocket may separate during flight, but they must remain attached by string or lanyard.



10. The rocket must be identified with the school and team name.

The Competition:

1. Any parts found to be dangerous (glass or metal), illegal (commercially made rocket parts) or that prevent a rocket fitting on the launch pad must be removed before the rocket can be launched. Rockets that are changed to meet the construction requirements will not be penalized. Rockets that cannot be made to fit on the launcher or those that in the event manager's judgment are unsafe will not be launched.
2. A Pitsco launcher will be used.
3. Two launches will be allowed. Different rockets may be used for each launch. Students must use the water, launch pad and source of pressure provided by the event supervisor. The students will add the desired amount of water to the rocket before each flight and may make alterations or repairs to rockets between launches. **Outside assistance/coaching from the sidelines is not permitted and will be grounds for disqualification.**
4. The judges will pressurize the rocket to 75 psi. Anyone within 10 meters of a pressurized rocket must wear eye protection. Contestants may not hold their rocket during pressurization. Please do not exceed this pressure when practicing. Only coaches should pressurize the rocket.
5. Once a rocket has been pressurized it must be launched. **In case of high wind, rocket needs to be launched** as quickly as possible. It will be the supervisor's decision whether the flight should be considered as unofficial due to the weather conditions.
6. Have parachutes packed and rocket ready before placing on the launcher.

Scoring:

1. Judges will measure and record the time aloft for each flight. Time starts when the rocket is launched and stops when any part of the rocket touches the ground, or any object in contact with the ground (tree or building.) Teams will be scored using only the flight that will produce the better score/rank.
2. Flights of rockets whose parts do not remain attached together during the entire flight or that cannot be changed to meet the construction requirements will be ranked by their time aloft, behind all flights of rockets without construction violations and whose parts remain attached.
3. Teams whose rockets cannot be launched for any reason will receive participation points only.
4. The longest time aloft wins. Ties will be broken using the team's lesser flights times. Teams with two flights will win ties over teams with only one flight.

Please note: Do not use parts of rockets from previous years. Judges may ask students how rocket was built. The students must have built the rocket.

Resources/Notes from EM:

We suggest removing plastic ring near the opening so rockets fit on launch easier.

B/C connection: Bottle Rockets



Event: Write It/Do It

Description: Technical writing skills are an important part of an engineer or scientist's abilities to communicate precisely and clearly. This event will test a team's ability to effectively communicate by having one team member write a description of how to build a device and having his or her partner re-construct the device from raw materials.

A Team Of: 2 **Approximate Time:** 50 min **Impound:** NO **Visitors:** NO

Teams: Teams must bring a writing instrument. No other resources are allowed.

Event Managers: Will provide paper and all necessary materials.

The Competition:

1. This event will occur in two rooms so that the builders are held while the describers are writing.
2. One team member (the writer) is shown an object (which may be abstract) built from, but not limited to science materials, inexpensive materials (straws, push pins, styrofoam balls, paper cups, popsicle sticks, etc.) or commercial sets (K'nex, Tinker Toys, Lego, Lincoln Logs, etc.)
3. The "object" will be the same for all teams.
4. A maximum of 20 pieces will be used.
5. No extra pieces will be added to the "do" portion.
6. The writer has 25 minutes to write a description of the object and how to build it. There will be no advantage to finishing early.
7. Only words and numbers may be used. Pictures, symbols, drawings and diagrams are not allowed, with the exception of common punctuation and editing symbols. Punctuation marks and/or editing symbols that can be produced on a keyboard by pressing a single key or a single key along with the shift key may be used as long as it is used in their normal context and not as symbols to form a key or code.
8. All abbreviations must be defined either at the beginning or when the abbreviation is first used.
9. The event leader will pass the description to the other team member (the doer) who will use the description to re-create the original object in twenty (20) minutes.

Scoring:

1. The team that builds the object most like the original object and has properly written instructions wins.
2. Points will be given for each piece of material placed in the proper connection and location compared to the model.
3. Time for the construction phase will be used as a tiebreaker.

Resources/Notes from EM:

B/C connection: *Write It/Do It*

