

# Science Olympiad

**Division A**

**Saturday, March 11, 2023**

**Updated 8/24/22**

# Science Olympiad Division A

## 2023 Events

A is for Anatomy	Herpetology
Barge Building	Metric Mastery
Boggle Science	Mystery Architecture
Can Race	Paddle Boat
Chopper Challenge	Pentathlon
Color Wheel	Rockhound
Crime Busters	Simple Machines
Deep Blue Sea	Straw Egg Drop
Dynamic Planet	Water Rockets
“Knock Knock- Who’s There?”	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 (SJC OE) during the COVID-19 pandemic. The SJC OE 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 2023

### Study

### Build

### Do

A is for Anatomy	Barge Building	Boggle Science
Deep Blue Sea	Can Race	Color Wheel
Dynamic Planet	Chopper Challenge	Crime Busters
Herpetology	Paddle Boat	Metric Mastery
Knock Knock-Who's There?	Straw Egg Drop	Mystery Architecture
Rock Hound	Water Rockets	Pentathlon
Simple Machines		Write It/Do It

### Sections

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

A is for Anatomy Barge Building Crime Busters Boggle Science	Paddle Boats Dynamic Planet Color Wheel Knock Knock	Chopper Challenge Deep Blue Sea Simple Machines Pentathlon	Herpetology Metric Mastery Can Race Write It/Do It	Straw Egg Drop Mystery Architecture Rockhound 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:

*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.

Resources/Notes from EM:

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

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

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.

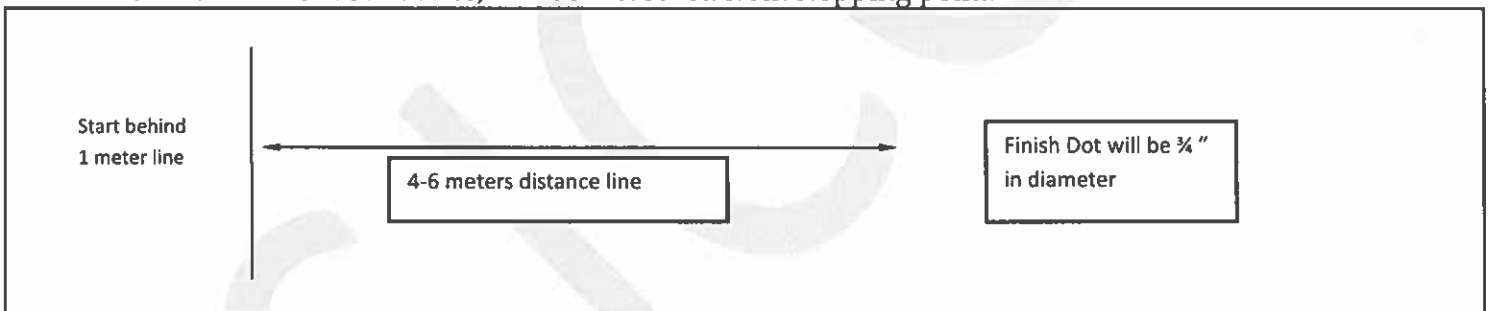
**Event Managers:** Will supply the track and timers and boundaries.

**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 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:**

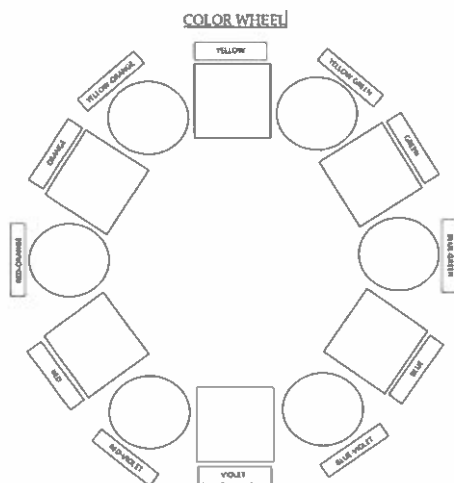
1. Students will be given a blank color wheel for their template as well as a color wheel for their reference.
2. Paint, paintbrush, water cup and paper towels will be provided.
3. ONLY Red, Yellow and Blue paint will be made available for participants to create their color wheel.
4. Students will mix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

**Scoring:**

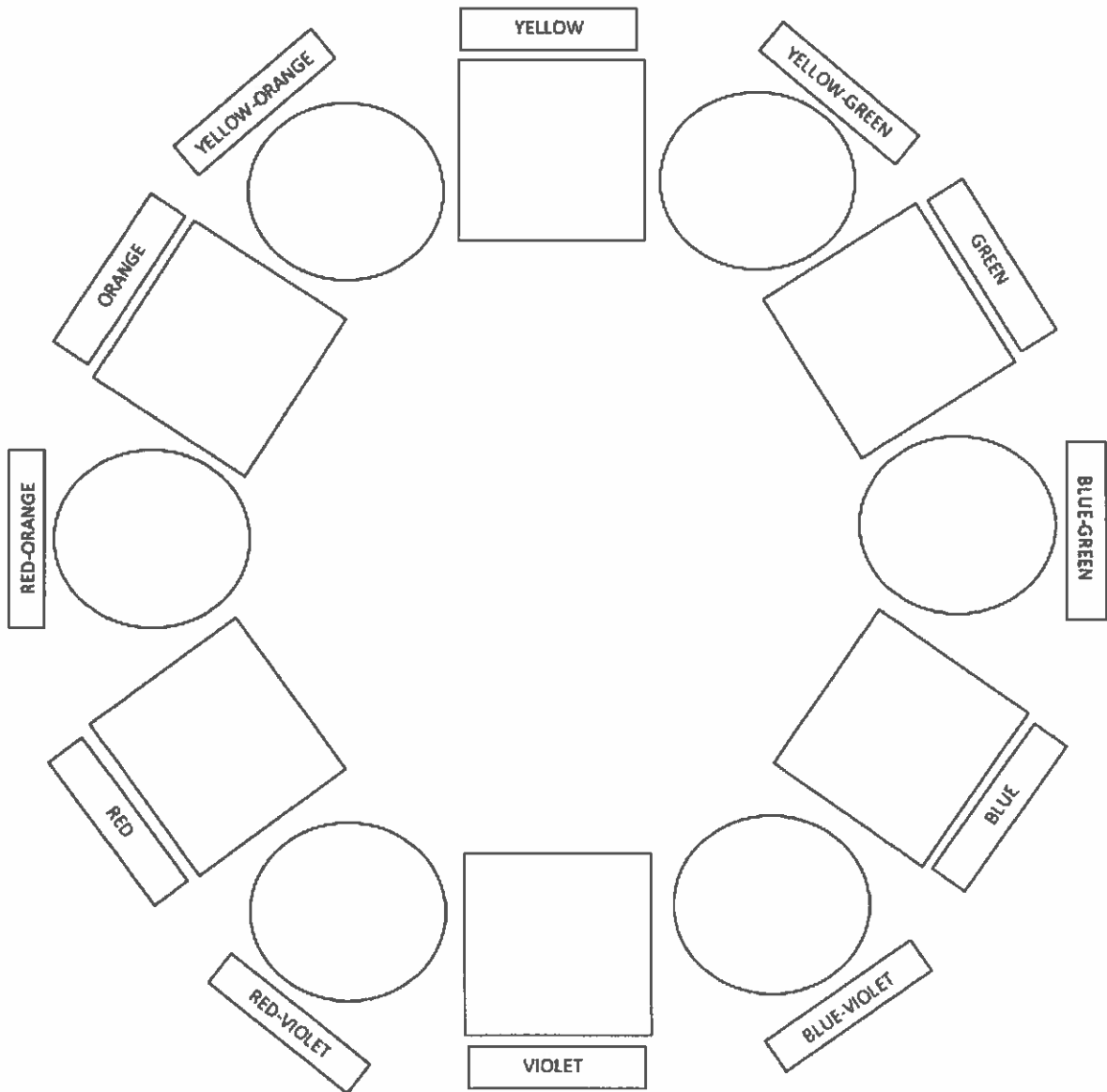
The scoring of the event will be based on the accuracy of their paint matching to the color wheel sample.

- 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: Crime Busters

**Description:** Participants use tests to identify unknown powders, match fingerprints and use paper chromatography to identify a note found at a crime scene.

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

**Teams:** Must bring lab coats or aprons, closed-toed shoes, chemical splash goggles and something to write with. Teams may bring an 8.5 x 11" two sided page of notes, in any form, from any source. Notes will be turned in.

**Event Managers:** Will provide all materials (including but not limited to: spot plates, small containers, plastic spoons, popsicle sticks or microspatulas, vinegar, iodine solution, water, hand lens, paper towels)

**The Competition:**

1. Teams will be supplied with the following materials to aid in the identification of the powders: water, vinegar, iodine solution (K13), a magnifying glass, and several plastic cups.
2. Teams will be asked to identify the following powders: granulated sugar, Plaster of Paris, salt, flour, cornstarch, baking soda, limestone and sand.
3. Tasting, touching or feeling of the substances, or unsafe handling of the equipment is NOT allowed.
4. No extra powder is provided, so students should practice with small amounts.
5. Some of the vials of powders will contain two powders. They will be identified by the event manager as "mixtures."
6. Students will be given a set of fingerprints from several suspects. They will be asked to match the fingerprints found at the scene, know the 3 basic types: loop, arch, whorl.
7. Student will need to perform simple chromatography and use results to help solve the crime.
8. Students will need to read a scenario for how the clues lead to a suspect.
9. After all the evidence is collected the students will be asked to identify who committed the crime and why they believe this is the criminal.
10. Students who do not have proper safety clothing or display proper safety behavior in lab will be disqualified.

**Scoring:** The score will be based on the following formula:

Identification of powders	50%
Chromatography	15%
Fingerprints	10%
Analysis, solving of crime	25%

Tiebreakers will be score of analysis first, completeness of notes second.

Resources/Notes from EM:

For practice, students may use calcium carbonate or take some chalk (don't use synthetic) and crush it, if limestone is not available.

Practice with several types of solvents and all types of pens.

*B/C connection: Crime Busters and Can't Judge a Powder*

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 pre-determined 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*

Event: Dynamic Planet

**Description:** Students will learn about the Earth's Fresh Water

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

**Teams:** Each team may bring in one set of two 8.5" x 11" double-sided pages of notes containing information from any source. Recommended that each participant bring in his/her own #2 pencil.

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

**The Competition:**

Participants will be presented with one or more tasks requiring their knowledge and understanding of the Earth's fresh water from the following topics:

- a. Structure of the water molecule, and special properties of water including but not limited to: the interaction of molecules, density, states of matter, specific heat capacity of water, etc.
- b. The distribution of the quantities of all water on Earth including oceans, glaciers, ground water, lakes, rivers, and the atmosphere.
- c. The hydrologic cycle including evaporation, precipitation, condensation, transpiration, respiration, infiltration, run-off, percolation.
- d. Water as an influencer of climate
- e. Formation of rivers and features of rivers including but not limited to head waters, waterfalls, knickpoints, riffles, rapids, meanders, point bars, spurs, interlocking spurs, ox-bow lakes, levees, flood plains, banks, cut-offs, tributaries, distributaries, channel, mouth. When answering questions on River features, remember to use the F.E.E.D. system. (Feature, Explanation, Example, Diagram)
- f. River flow and effects including but not limited to discharge, capacity, competence, sorting (grading of sediments: rocks, pebbles, sand, silt, clay), load: solution, suspension, and bedload (traction, saltation) erosion and deposition, roundness of rocks
- g. Special rivers to know: Amazon, Congo, Ganges, Mississippi
- h. Types of lakes: by Carlson's Trophic Index: oligotrophic, mesotrophic, eutrophic, hypereutrophic
- i. Structure of Lakes: determined by factors such as turbulence, temperature, water clarity, habitat size, and water depth. Thermal stratification layers: the Epilimnion, the thermocline (or Metalimnion), and the Hypolimnion. Another way to describe different zones that divide the water column from top to bottom and side to side are the Littoral Zone, Limnetic Zone, Profundal Zone, Euphotic Zone, and Benthic Zone.
- j. Formation and characteristics of specific lakes: Lake Baikal, Great Lakes, Lake Mead, Crater Lake
- k. Ground water: zone of saturation, water table, impermeable layer, subsidence, aquifer

**Representative tasks:**

- a. By examining and analyzing a picture or diagram, tell whether the landscape is erosional or depositional, age of a river, how a feature formed
- b. Describe the climate of 2 areas at same latitude, 1 near a body of water and the other not near.

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

**Resources/Notes from EM:**

Have students practice taking timed tests

*B/C connection: Dynamic Planet*

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: Herpetology

**Description:** This event will test students on their knowledge of **reptiles and amphibians**.

**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 and tests. The test may include various formats such as: slides, stations, written answers, scantrons, multiple choice, etc.

**The Competition:**

1. Each team will be given an answer sheet on which they will record answers.
2. The event may include living and preserved specimens, skeletal materials and/or slides or pictures of specimens.
3. Both **Class Reptilia** and **Class Amphibia** specimens on the **2022 Herpetology List** will be used. Only specific sections of the **Class Reptilia** list will be used. Please consult the list on the following page.
4. Only **common names** will be used.
5. Teams will be asked to do basic identification and demonstrate knowledge of anatomy and physiology, reproduction, habitat characteristics, ecology, diet, behavior, conservation, sounds and biogeography.
6. The focus will be on reptiles and amphibians of North America.

**Scoring:** High score wins. Selected questions may be used as tie-breakers.

**Possible Question/Station:**

- Compare and contrast a crocodile with an alligator.
- Identify the order and family of the provided sample.
- Based on the dental structure of this organism, predict the type of food this organism eats.
- Is this organism native to North America or is it an introduced species? Where is it originally from?
- What makes this organism unique?

Resources/Notes from EM: These books are a good starting point but be sure to use all available resources.

National Audubon Society Field Guide to Reptiles and Amphibians North America – ISBN: 978-0-394-50824-5

Peterson Field Guide to Western Reptiles & Amphibians – Fourth Edition – ISBN: 978-1-328-71550-0

Peterson Field Guide to Reptiles and Amphibians of Eastern and Central North America – Fourth Edition – ISBN:978-0-544-12997-9

See provided handout with more information.

*B/C connection: Herpetology*

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, cm<sup>2</sup>, cm<sup>3</sup>) 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](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*

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.

Event: Pentathlon

**Description:** Teams, consisting of 4 members, will compete in an event in with five stations. There will be four stations for individual team members to answer a science question and complete a physical task. The fifth station will be a cooperative activity completed by all 4 members.

**A Team Of:** 4      **Approximate Time:** 5 min      **Impound:** NO      **Visitors:** YES

**Teams:** Teams must have 4 students. Students should wear athletic clothing and close toed shoes for completing physical task.

**Event Managers:** Will supply all materials to complete each station.

**The Competition:**

1. The course will be run as a relay for the first four obstacles and a cooperative team activity for the last obstacle.
2. Each obstacle must be completed before moving on. An example of a physical task is dribbling a basketball around a series of cones.
3. Each station will have multiple choice questions from one of the four study areas:  
**Earth Science: Earth's Surface, Water Weather, Earth's Resources, Ecosystems**  
(no other information will be given prior to the event)  
Multiple choice questions will be shown and read in decreasing difficulty until one is answered correctly or after 5 missed questions. (see scoring below)
4. The event manager will tell the team what topics are at each station before team starts.
5. Once a team member completes both portions of the station, they must tag the next team member to continue.
6. When the four team members have completed their obstacles, they will join together at the fifth station to complete the cooperative-physical team activity.
7. Coaches and parents will not be allowed to enter the competition area.
8. This event may be held outdoors.

**Scoring:** The shortest time will determine the winning team. Time will be determined by the amount of time to complete the course added to the following time penalties for missing questions at each station.

At a station, if a student:

-answers their first question correct:	no time is added
-answers their second question correctly:	2 seconds added
-answers their third question correctly:	4 seconds added
-answers their fourth question correctly:	6 seconds added
-answers their fifth question correctly:	10 seconds added
-misses all 5 questions:	15 seconds added

**Possible Question/Station:**

- make a basket in the basketball hoop
- do 10 jumping jacks

**Resources/Notes from EM:**

Event: Rock Hound

**Description:** Students will prepare charts, identify rocks and minerals and describe their characteristics.

**A Team Of Up To:** 2      **Approximate Time:** 20min      **Impound:** NO      **Visitors:** NO

**Teams:** Teams should bring in completed charts in students own handwriting to be used in the identification process and to aid in answering questions. Charts can be any size, in any form, from any source. No books allowed. (See chart sample)

**Event Managers:** Will provide all necessary items, objects, materials, questions and response sheets for students to complete stations

**The Competition:**

1. Teams will be asked to identify the following rocks and minerals:

**Rocks**

basalt	bituminous coal	conglomerate	gneiss
granite	limestone (fossil)	marble	obsidian
pumice	quartzite	sandstone	schist (garnet)
scoria	shale	slate	

**Minerals**

calcite	copper	feldspar (pink)	fluorite
galena	graphite	gypsum-satin-spar	halite
hematite	mica-biotite	pyrite	kaolinite
quartz (chert)	quartz (crystal)	talc	

2. Students will also be asked questions about the rocks or minerals, such as their color, density, (relative heaviness per volume), relative hardness, reaction to vinegar, shape, texture, etc.
3. Students should bring their completed charts with them to the tournament. The charts may be used in the identification process and to aid in answering any questions. Charts and answer sheets will be collected at the end of the twenty-minute period.

**Scoring:** High score wins. In case of ties, contestants with the most complete and accurate charts will be the winners.

**Possible Question/Station:**

- This specimen is called---
- What is this rock or mineral often used to make?
- It comes in ----- colors (1, 2, 3 or 4)
- It has a hardness of-----

Resources/Notes from EM:

Students may type chart instead of hand write, however EM encourages own handwriting to help memorize.

Four important things to remember:

1. Read the rules
2. Get the books
3. Do the chart
4. Practice with rock kit

Rocks and Minerals from National Audubon Society

National Audubon Society, First Field Guide, Rocks & Minerals, Scholastic ISBN O-590-05484-8 paperback, ISBN -0-590-05463-5 hard back (Not the \$19. ISBN:0-394-50269-8 as it is too complicated)

Eyewitness Series: Rocks and Minerals  
Guide to the Elements

To answer the question: What do they make rocks into? A Guide to the Elements, by Albert Stwertka, Oxford University Press ISBN-13: 978-0-19-515027-8 Usually one page or so of mineral uses with pictures, very interesting

My Rock Chart Sample

Rock	Color	Streak	Layers	Texture	Shiny	Harness	Other
A							
B							
C							
D							

Relative Hardness (Moh's Scale)

Material	What it will do	Rating
Talc	Most everything scratches it	1
Gypsum	A fingernail will scratch it	2
Calcite	A copper penny will scratch it	3
Fluorite	A steel knife will scratch it	4
Apatite	A knife scratches it if you press hard	5
Feldspar	Will scratch a knife blade	6
Quartz	Will scratch glass (and all previous)	7
Topaz	Will scratch quartz (and all previous)	8
Corundum	Will scratch all except a diamond	9
Diamond	Will scratch everything	10

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.

Event: Straw Egg Drop

**Description:** Each pair of students will make a device of straws and masking tape, supplied on-site by the event supervisor, to hold a raw, large, grade-A egg. The device containing the egg will be dropped from a fixed height to a target.

**A Team Of Up To:** 2      **Approximate Time:** 45 min      **Impound:** NO      **Visitors:** YES

**Teams:** Teams may not bring in any supplies or materials.

**Event Managers:** Will supply:

- 20 plastic, non-flexible straws (brand will not be share before the event)
- One meter of 1" masking tape
- Scissors
- Raw egg

**The Competition:**

1. Students will have 20 minutes to construct a device to cushion the egg and prevent it from cracking or breaking. They will have 10 minutes to drop the device from a height of 2-8 meters onto a target. No tape may be attached to the egg.
2. There will be ONE drop per team from the prescribed height.
3. Plumb lines will not be allowed during the competition.
4. This event may be held outdoors.

**Scoring:**

1. Teams whose egg is unbroken after the drop will be ranked ahead of all teams whose egg is broken.
2. Teams whose egg is broken during the drop will be ranked after all teams whose egg is unbroken.
3. Teams whose egg is broken before the official drop will drop the empty container and be ranked after all teams whose egg is broken during the drop.
4. Teams in each of the three groups above will be ranked by the distance measured from the center of the bulls-eye to the farthest edge of the container or the farthest edge of any parts thrown from the container (not the egg.)
5. The winning team will be the team whose egg does not crack or break AND is the closest to the target. In the event of a tie, construction time for building the containers will be the deciding factor.

Resources/Notes from EM:

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.

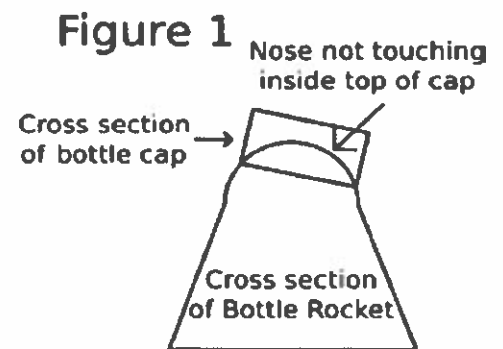
**A Team Of:** 2-3      **Approximate Time:** 10 min      **Impound:** NO      **Visitors:** YES

**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*