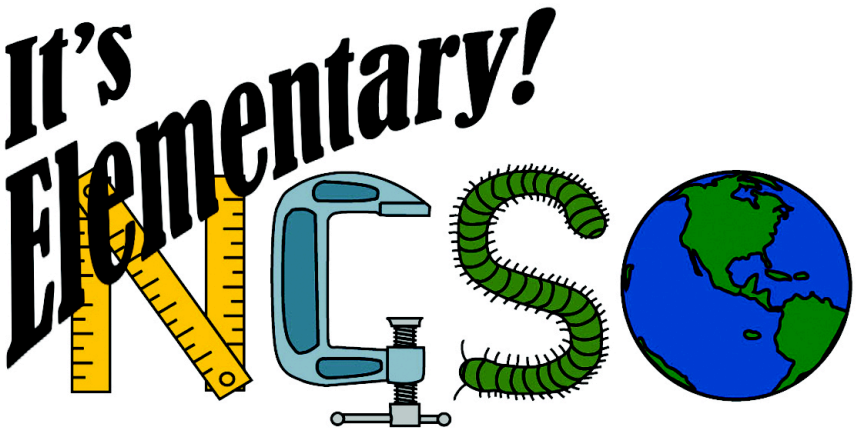



North Carolina Science Olympiad

# 2021 Event Manual

# Division A

North Carolina Science Olympiad ©2021

**Elementary Tournament Big Picture**

It can be difficult to describe what an NCSO tournament to someone who has not seen one before. One hint: It looks a lot more like a track meet than a science fair.

During an elementary Science Olympiad tournament in North Carolina, 15 - 19 events are run in three different time periods. A **sample** tournament schedule is given below. ***Your tournament may look different this year. If it is a virtual tournament, the events will still occur in these blocks together. Be sure to check your tournament webpage for your exact schedule. Tournament directors will post these schedules as soon as we know what schools will allow in the spring.***

## Proposed 2021 Elementary Tournament Schedule

| Times | Events |
|---|---|
| 7:45 – 8:25 am | Registration |
| 8:30 – 8:55 am | Opening Ceremony |
| Period 1 (9:00 - 10:10 am) | 3,2,1 Blast Off! (choose 1 period for your team to compete) |
| | Animal Adaptations |
| | Describe It, Build It |
| | Marshmallow Catapult |
| | ProGamers |
| | Pump It Up |
| | Weather Permitting |
| Period 2 (10:20 am - 11:30 am) | 3,2,1 Blast Off! (choose 1 period for your team to compete) |
| | Bridgearoni (choose 1 period for your team to compete) |
| | Genes R Us |
| Impound by 8:30 | Movers & Shakers |
| | Ramp and Roll |
| | Science Charades |
| | Super Sleuths |
| Period 3 (11:40 am - 12:50 pm) | Backyard Biologist |
| | Bridgearoni (choose 1 period for your team to compete) |
| | Codebusters (trial in some regions, check your tournament page) |
| | Data Crunchers |
| | Rock Star |
| | Sky Quest |
| | What's the Matter? |
| 1:00 - 1:45 pm | Lunch |
| 1:45 – 2:15 pm | Closing/Awards Ceremony |

## 2021 NCSO Elementary Event Descriptions

**3, 2, 1, Blast Off!** (3.P.1, 5.P.1, Science as Inquiry)
Prior to the tournament, teams will construct up to two rockets designed to keep a standard ping pong ball aloft for the greatest amount of time.

**Animal Adaptations** (2.L.1, 4.L.1)
Teams will be assessed on their knowledge of various animal adaptations and how those adaptations benefit the animals.

**Backyard Biologist** (1.E.2, 1.L.1, 2.L.1, 3.L.2, 6.L.1)
Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. In 2021, the focus will be on plants, trees and birds. Teams will be required to identify organisms from a provided list and know about the habitat and conditions required for growth of the organisms and which ones are North Carolina state symbols.

**Bridgearoni** (Science as Inquiry)
The objective of this event is to design and build a bridge, constructed only of pasta and glue, with the greatest structural efficiency. This means building a light, but strong bridge capable of supporting a load of up to 10 kg.

**Codebusters** (Science as Inquiry)
Teams will decode encrypted messages using cryptanalysis techniques for historical and modern advanced ciphers.

**Data Crunchers** (Measurement & Data, 5.P.1, NC.4.MD.4, NC.4.NF.2, NC.5.MD.2, NC.6.SP.1-5.)
Teams should be able to create and interpret data tables, bar graphs, line graphs, pie charts, and pictographs and perform simple experiments to collect data, graph their results and make predictions.

**Describe It, Build It** (Science as Inquiry)
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 construct the device from raw materials using their partner's description.

**Genes R Us** (2.L.2, 5.L.3)
Teams will demonstrate an understanding of traits that may or may not be inherited, be able to explain why organisms share similarities and differences, and use Punnett squares to predict inheritance patterns of certain characteristics.

**Marshmallow Catapult (**Science as Inquiry)
Teams will build in advance a device constructed out of specified materials to launch a marshmallow at a target placed on the floor. The goal is to land as close to the center of the target as possible.

**Movers & Shakers** (3.E.2)
Teams will be assessed on their knowledge of plate tectonics, earthquakes, volcanoes and related land formations.

**ProGamers** (Information & Technology)
Teams of students will use the Scratch 3.0 programming language to recreate a game that is shown to them without the code.

**Pump it Up!** (3.L.1, 4.L.2, 5.L.1)
Teams will demonstrate knowledge of the human Circulatory & Respiratory system.

**Ramp and Roll** (3.P.1, 5.P.1)
Teams will build a ramp and vehicle to travel a certain distance and stop as close to the finish point.

**Rock Star** (3.E.2, 4.P.2)
Teams will demonstrate their knowledge of rocks & minerals, the rock cycle and geologic maps.

**Science Charades** (Science as Inquiry)
Team members will take turns acting out clues for scientific terms or concepts from across all Essential Standards for Elementary Math & Science. Teams of up to 3.

**Sky Quest** (1.E.1, 3.E.1, 4.E.1, 6.E.1)
Teams will be tested on their knowledge of the solar system. Topics include the sun, moon, planets, rotation and revolution, moon phases, seasons, space exploration missions and identification of constellations/stars/asterisms based on a provided list.

**Super Sleuths** (3.P.2, 4.P.2, 5.P.2, Science as Inquiry)
Given a mystery scenario, evidence, and a list of possible suspects, teams will be expected to perform a series of tests to draw specific conclusions about the scenario and suspects. The test results along with other evidence will be used to solve the mystery of the scenario.

**Weather Permitting** – (K.E.1, 2.E.1, 5.E.1)
This event will test the team's knowledge of conducting investigations and using appropriate technology to build an understanding of **Everyday Weather.**

**What's the Matter?** (2.P.2, 3.P.2, 4.P.2, 5.P.2, 6.P.2)
Teams will be assessed on their knowledge of the physical properties of matter and the behavior of solids, liquids, and gases before and after they undergo changes or interactions.

# 3, 2, 1, Blast Off!

1. **DESCRIPTION**: Prior to the tournament, teams will construct up to two rockets designed to keep a standard ping pong ball aloft for the greatest amount of time. **In 2021, the pressure vessel must be a 2-liter bottle.**

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.1, 5.P.1, Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS**: Must bring up to 2 rockets, 2 ping pong balls, 2 recovery systems, carbonated beverage bottle labels (if removed), and safety glasses. Teams may also bring funnels, measuring cups, and/or other tools to help prepare their rockets.

6. **EVENT LEADERS**: Will provide water rocket launcher, water, score sheets, and timers.

7. **SAFETY REQUIREMENTS**: Teams must wear safety glasses rated Z87+ during the loading, launching, and retrieving of their rockets.

8. **IMPOUND**: No

9. **CONSTRUCTION PARAMETERS**:

   a. **PRESSURE VESSEL**: The rocket pressure vessel is the part of the rocket that attaches to the launcher and is filled with water and air. The pressure vessel must be made out of a single 2-liter plastic carbonated beverage bottle.
      i. **LABELS** may be removed from the bottle, but labels must be presented at the safety inspection to prove that the bottle is carbonated. *Rockets without labels must not be launched, as this is a safety issue.*
      ii. **BOTTLE OPENING**: Not all bottles are made the same, and there is no one specific brand that is guaranteed to work. Some bottles will not fit on the launcher. The easiest way to test this is by sliding a piece of 1/2 inch PVC into the bottle. If it fits loosely, the bottle will go on the launcher. If the PVC sticks and you have to apply any force to slide the PVC in, the bottle will not go on the launcher. See the event resource page for assistance.
      iii. **STRUCTURAL INTEGRITY**: The structural integrity of the pressure vessel must not be altered. This includes, but is not limited to: physical, thermal, or chemical damage (e.g., cutting, sanding, using any glues). Event supervisors must assess the structural integrity by looking through the nozzle and sides of the bottle for discoloration, bubbles, thinning or cuts in the walls or glue of any kind. *Rockets violating this rule must not be launched, as this is a safety issue.*

   b. **MATERIALS**:
      i. Metal of any type (including tape with metal fibers) is prohibited everywhere on the rocket. *Rockets violating this rule must not be launched; this is a safety issue.*
      ii. Toy or professional rockets or parts of rockets are not allowed.

   c. **NOSE CONE:** Rockets must use a blunt or round nose. The nose must be designed such that when a standard 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). Teams must not use a nose that is sharp, pointed, or consisting of a rigid spike regardless of the material used. *Rockets violating this rule must not be launched; this is a safety issue.*

   d. **FINS and OTHER PARTS**: Fins and other parts added to the pressure vessel must be 5 cm or higher above the level of the bottle's opening to ensure the rocket fits on the launcher (see Figure 2). Allow teams to fix if wrong.

   e. **ENERGY SOURCE**: Explosives, gases other than air, chemical reactions, pyrotechnics, electric or electronic devices, elastic powered flight assists, throwing devices, remote controls and tethers are prohibited at any time. All energy imparted to the rocket at launch must originate from the water/air pressure combination. *Rockets violating this rule must not be launched, as this is a safety issue.*

**Figure 1**

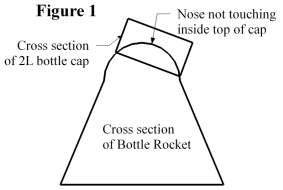
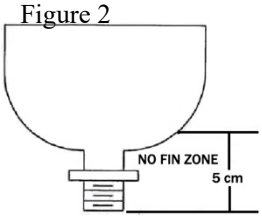



Figure 2



f. **RECOVERY SYSTEM**: Any free-fall recovery system is allowed, provided that it does not violate any other rule; however, the recovery system must be judged as safe.
g. **PING PONG BALL:** A standard ping pong ball must be launched with the rocket. It must separate from the rocket after launch. It may be attached to a recovery system in any way that does not change the ball. Tape & tying strings work well, sanding, drilling holes or gluing are not allowed.

10. **THE COMPETITION**:

a. All rockets must be launched using the launcher and water provided by the supervisor.
b. Only one launch is allowed per rocket. If a team wishes to use both launches, they must have 2 rockets.
c. Teams must arrive at the competition site ready to launch. Teams must bring and wear safety glasses for loading, launching, and retrieving their rockets. Allow teams to get eye protection if at all possible. Teams must also present labels from the pressure vessel if labels were removed. Following the safety inspection of each rocket, teams will add water to each rocket. When called to launch, the teams will have a total of 10 minutes to launch 1 or 2 rockets brought to the competition (only 1 launch per rocket). Only rocket(s) launched before the time expires will be scored. Teams may not share rockets with other teams (i.e. a varsity team may not loan a rocket to a JV team from the same or different schools). **Pieces from 1 rocket cannot be recycled for use on the second rocket.**
d. All rockets will be launched at **60 psi**. Once the rocket is pressurized, no contestant may touch or approach the rocket.
e. Time aloft is recorded in tenths of a second. Timing begins when the rocket separates from the launcher and stops when the **ping pong ball** touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction.
f. If the ping pong ball falls off during launch, a time of 1 sec will be recorded and the Rocket will remain in Tier 1.
g. If the ping pong ball does not separate from the rocket, the time will be recorded until the rocket touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction. The Rocket will be moved to Tier 2.
h. If the Rocket does not have a ping pong ball, it can still be launched and time will be recorded until the rocket touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction. The Rocket will be moved to Tier 2.
i. Event leaders are strongly encouraged to use three independent timers on all launches. The middle value of the three timers should be the officially recorded time.

11. **SCORING:**
a. Rockets that violate a safety-related rule under Construction Parameters will not be launched and will receive participation points only.
b. Ranking within each tier is determined by the greatest time aloft for **one rocket** flight.
    i. Tier 1: Rockets launched without any violations
    ii. Tier 2: Any launch with competition violations, or a non-safety construction violation.
c. Ties in tiers 1 and 2 are broken by the better combined score of each tied team's rocket flights.

12. **EVENT RESOURCES**:
See the Event Resources tab on our website for instructions, videos and more.

# 3,2,1 Blast Off! 2021 Score Sheet *(revised 3/26/20)*

School Name: _____ Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

| ROCKET 1 | ROCKET 2 |
|---|---|
| **Safety Criteria** | **Safety Criteria** |
| _____9.a. Used 2-liter plastic carbonated beverage bottle. | _____9.a. Used 2-liter plastic carbonated beverage bottle. |
| _____9.a.i. Teams presented labels if removed from pressure vessel or label was still on bottle. | _____9.a.i. Teams presented labels if removed from pressure vessel or label was still on bottle. |
| _____9.a.iii. Structural integrity of pressure vessel unaltered (no cutting, sanding, using any glues on *pressure vessel*). | _____9.a.iii. Structural integrity of pressure vessel unaltered. (no cutting, sanding, using any glues on *pressure vessel*). |
| _____9.b. No metal parts anywhere on rocket. | _____9.b. No metal parts anywhere on rocket. |
| _____ 9.b. No commercial rockets or parts. | _____ 9.b. No commercial rockets or parts. |
| _____9.c. Rocket has a blunt or rounded nose. | _____9.c. Rocket has a blunt or rounded nose. |
| _____9.e. Only water/air used at launch. | _____9.e. Only water/air used at launch. |
| _____9.f. Recovery system is safe. | _____9.f. Recovery system is safe. |
| _____7. Wearing Z87+ impact rated safety glasses or impact rated goggles at all times (one warning ok). | _____7. Wearing Z87+ impact rated safety glasses or impact rated goggles at all times (one warning ok). |
| If any safety criteria above are not met, do not launch. | If any safety criteria above are not met, do not launch. |
| **Construction Criteria** | **Construction Criteria** |
| _____9.d. All parts of rocket are 5 cm or further from opening of bottle. If not, allow team to step out of line and attempt to fix. | _____9.d. All parts of rocket are 5 cm or further from opening of bottle. If not, allow team to step out of line and attempt to fix. |
| _____10.h. Ping Pong Ball is launched with rocket. If no, then Tier 2. | _____10.h. Ping Pong Ball is launched with rocket. If no, then Tier 2. |
| _____10.g. Ping Pong Ball separates from rocket. If no, then Tier 2. | _____10.g. Ping Pong Ball separates from rocket. If no, then Tier 2. |
| Rocket 1 Time Aloft (sec) ***Record all times.*** ***(****Time until ping pong ball lands)*<br><br>(Use time from middle of 3 timers): _____ | Rocket 2 Time Aloft (sec) ***Record all times (****Time until ping pong ball lands)*<br><br>(Use time from middle of 3 timers): _____ |

Tier (Circle one): 1 2 Greatest Time Aloft for best rocket: _____ Final Rank: _____
*Tiebreaker: Greatest combined time aloft.*

# Animal Adaptations

1. **DESCRIPTION**: Teams will be assessed on their knowledge of various animal adaptations and how those adaptations benefit the animals.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.L.1, 4.L.1

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will consist of an exam that covers any or all of the following topics.

   a. Describe and explain how behaviors and body structures help different animals survive in a particular habitat.
   b. Describe ways that animals can adapt their behavior to live in changing habitats and explain why the adapted behaviors work.
   c. Observe the adaptations of different animals and describe the habitat that best supports those adaptations including:
      i. How to get food
      ii. How to avoid predators
      iii. How to protect their young
      iv. How to survive in different physical environments
   d. Design (e.g. draw and label) an animal with certain adaptations that would allow it to survive under certain environmental conditions.

9. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to pre-selected questions chosen by the event leader.

10. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Backyard Biologist

1. **DESCRIPTION**: Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. **In 2021, the focus will be on trees, plants & birds.** Teams will be required to identify organisms from a provided list and know about the habitat and conditions required for growth of the organisms.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.L.1, 3.L.2, 6.L.1, 6.L.2

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. Teams may also bring up to 2 commercially produced field guides and/or 2 1-inch, 3-ring binders with pages in any form, from any source, contained in the rings. (This means 2 guides, or 2 binders, or a guide and a binder). Actual plant & leaf samples are allowed in the binders as long as they are in plastic sheet protectors. No animal parts are allowed in the binder. Teams may also bring up to two hand lenses.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exams. Examples include but are not limited to: drawings, scenarios, questions, leaves, bark, seeds, photographs, and specimens.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will consist of an exam that covers any or all of the following topics.

    a. Identification of specimens, by common name, from the Official Specimen List, including which are NC official state symbols. No more than 50% of the test will be identification of specimens.
    b. Plants and trees
        i. The structure and function of roots, stems, leaves, seeds, and flower parts.
        ii. The life cycle of plants and how they make energy (e.g. basic photosynthesis, no chemical equations).
        iii. The concepts of gravitropism, phototropism, thigmotropism, & hydrotropism.
    c. Horticulture
        i. What is needed to grow a successful garden and harvest food to eat, including how plants react in different conditions (no light, too much/too little water, addition of fertilizer, competition with other plants, etc).
    d. Birds
        i. Basic characteristics and description of habitat
        ii. Eating habits, and life cycles.
        iii. Importance to the ecosystem and impact on humans or human activities

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Backyard Biologist – 2021 Official Specimen List

*For identification, students only need to know the common name and if it is an official NC State Symbol. Scientific names are given for reference purposes only.*

| **Trees** (Identify by leaves, bark, and seeds): | **Birds (Identify by songs, calls, and coloring)** |
|---|---|
| American elm *(Ulmus Americana)*<br>Bitternut hickory *(Carya cordiformis)*<br>Black cherry *(Prunus serotina)*<br>Black oak *(Quercus velutina)*<br>Eastern white pine *(Pinus strobus)*<br>Flowering dogwood (*Cornus florida*)<br>*NC State Flower<br>Southern live oak (*Quercus virginiana)*<br>Loblolly pine *(Pinus taeda)***<br>Longleaf pine *(Pinus palustris)***<br>Red maple *(Acer rubrum)*<br>Shortleaf pine (*Pinus echinata)***<br>Southern red oak *(Quercus falcate)*<br>Sweet gum *(Liquidambar styraciflua)*<br>Tulip/yellow poplar *(Liriodendron tulipifera)*<br>White oak *(Quercus alba)*<br><br>**Bushes, Vines, and Flowers**<br>English ivy (*Hedera helix*)<br>Carolina lily (*Lilium michauxii*)<br>*NC State Wildflower<br>Eastern poison ivy (*Toxicodendron radicans*)<br>Carolina rose (*Rosa carolina*)<br>Kudzu (*Pueraria lobata*)<br>Pink lady's slipper (*Cypripedium acaule*)<br>Scuppernong grape (*Vitis rotundifolia*)<br>*NC State Fruit<br>Sunflower (*Helianthus annuus*)<br>Venus flytrap (*Dionaea muscipula*)<br>*NC State Carnivorous Plant<br>Butterfly weed (*Asclepias tuberosa*)<br>Trumpet creeper (*Campsis radicans*)<br><br>* State Symbol<br>** Pine trees (generic) are the NC state tree | American robin (*Turdus migratorius*)<br>American crow (*Corvus brachyrhynchos*)<br>Blue jay (*Cyanocitta cristata*)<br>Brown-headed nuthatch (*Sitta pusilla*)<br>Carolina wren (*Thryothorus ludovicianus*)<br>Downy woodpecker (*Picoides pubescens*)<br>Eastern bluebird (*Sialia sialis*)<br>Eastern towhee (*Pipilo erythrophthalmus*)<br>House finch (*Carpodacus mexicanus*)<br>Mourning dove (*Zenaida macroura*)<br>Northern cardinal (*Cardinalis cardinalis*)<br>*NC State Bird<br>Red-bellied woodpecker (*Melanerpes carolinus*)<br>Tufted titmouse (*Baeolophus bicolor*)<br>Turkey vulture (*Cathartes aura*)<br>White-breasted nuthatch (*Sitta carolinensis*) |

# Bridge-a-Roni

1. **DESCRIPTION**: The objective of this event is to design and build the lightest bridge, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg. Each team may bring and enter only one pasta bridge.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS**: Teams must bring bridge and safety glasses.

6. **EVENT LEADERS**: Will provide all equipment, except for eye protection, needed for testing and scoring. The equipment needed is as follows:
   a. A testing platform with two elevated flat support surfaces (e.g. blocks of wood) 40.0 cm apart from each other, at least 15 cm wide.
   b. A square loading block, 5.0 cm long x 5.0 cm wide x 2.0 cm tall (+/- 1 mm) with a hole drilled in the center of the square face. Connected through this hole will be a ¼" eyebolt (with wing nut and washer) connected to a chain. The loading block and chain assembly is placed on the bridge by the team during testing and used to suspend the bucket and sand beneath the bridge.

   c. An electronic balance or scale that can mass up to 12 kg (the "sand scale") and one that can mass a bridge up to 400 g to the nearest 1 g (the "bridge scale"). Bridges exceeding the capacity of the bridge scale will be massed on the sand scale instead.
   d. A plastic tarp to protect floor from sand, if needed.

7. **SAFETY REQUIREMENTS**: Teams must wear safety glasses throughout event.

8. **IMPOUND:** None

9. **CONSTRUCTION:**
   a. The bridge is to be a single structure constructed of ONLY pasta, multi-purpose glue, and/or hot glue. Multi-purpose glue must be labeled safe and non-toxic (e.g. Elmer's). Other materials are not allowed, including paint, rubber bands, twist ties, other types of glue, etc.
   b. The bridge must be free standing and span a **40.0 cm** distance while resting on top of the testing platform.
   c. The bridge shall not exceed **55.0 cm** in length, **15.0 cm** in width, and not extend below the top of the testing platform when unloaded.
   d. **The minimum height of the bridge is 10.0 cm**; there is no maximum height on the bridge.
   e. The bridge must support, at the center of its span, the loading block and chain assembly described in 6.b. The bridge must have an adequately sized opening at its center that allows the bolt and chain to pass through the bridge and hang below the bridge. The loading block assembly must rest freely on the bridge and cannot be rigidly attached to the bridge.
   f. If the bridge has multiple levels, the team may decide which level to place the loading block on, as long as it remains at the center of the span.

10. **<u>THE COMPETITION</u>**:
    a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they are finished competing. Only contestants and judges will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.
    b. All bridges must be measured and weighed prior to testing.
    c. Teams must strive to handle the bridge themselves throughout the process of measuring and loading. Event leaders should only handle bridges as a last resort.
    d. Teams must place the bridge on the testing platform themselves so that the ends of the bridge rest on the top surfaces of the testing platform.
    e. Teams will place the loading block on the bridge at the center of its span so the chain hangs freely without touching the testing platform, and connect a 5 gallon bucket to the chain below the testing platform.
    f. The team will be given **3 minutes** to load sand into the bucket once the loading block and bridge are positioned.
    g. Loading must stop when failure of the bridge occurs, when the maximum load of 10 kg is supported, or when the time expires. Failure is defined as the inability of the bridge to support additional load, or something other than the bridge is supporting the load (i.e., the bridge leans and chain touches edge of platform, or sags enough that the bucket touches ground, or part of the bridge sags below the top of the testing platform).
    h. Event leaders will remove sand added after failure occurs. Event leaders will also remove any pasta bits that fall into the sand. The Load Supported at that time will be used to calculate the Structural Efficiency.
    i. The mass of the loading block assembly, bucket, and sand are included in the Load Supported.

11. **<u>SCORING</u>**:
    a. The best structural efficiency (highest number) wins, determined by the following equation:
    Structural Efficiency = Load Supported (grams) ÷ Mass of Bridge (grams)
    b. Bridges that hold more than 10 kg will be scored using 10 kg (10,000 g) as the maximum Load Supported.
    c. Bridges will be scored in 2 tiers:
    Tier 1: Bridges with no violations
    Tier 2: Bridges with construction violations
    Bridges that cannot be tested for any reason (e.g. cannot accommodate the loading block or team does not have proper eye protection) will be given participation points only.
    d. Ties will be broken in favor of the team with the lighter bridge.

12. **<u>RESOURCES</u>**:
    See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.

## Bridge-a-Roni Score Sheet – 2021 *(revised 3/26/21)*

School Name: _____Team (Circle One): Varsity JV1 JV2 JV3 JV4

Student Names:_____

**<u>Safety Criteria</u>: Teams must wear proper eye protection at all times during launches. No dangerous objects or substances are used. If this criterion is violated, then the device cannot be tested.**

**Are all safety criteria met by the team and device? _____ If yes, continue.**

Mass of bridge: _____ g

| | | YES | NO |
|---|---|---|---|
| *1.* | *The bridge is to be a single structure constructed of ONLY pasta, multi-purpose glue, and/or hot glue.* | _____ | _____ |
| *2.* | *The bridge is free standing and spans a 40.0 cm opening while resting **<u>on top</u**** *of the testing platform blocks.* | _____ | _____ |
| *3.* | *The bridge is <u>≤</u> 55.0 cm in length, <u>≤</u> 15.0 cm in width, <u>≥</u> 10.0 cm in height <u>and</u> does not extend below the top of the testing platform when unloaded.* ***(circle violation if there is one)*** | _____ | _____ |
| *4.* | *The bridge supports the loading block and chain assembly at the center of its span and allows chain to hang freely.* | _____ | _____ |

***Teams with a "no" checked above will be placed in Tier #2.*** ***Tier =*** _____

***Teams with no eye protection or who continue to remove eye protection after warnings or devices that can not be tested will be given participation points only.*** ***Participation only?*** _____

***If the team left the area or received outside help during loading, then check here for disqualification.*** ***DQ?*** _____

*Check the reason testing stopped.* _____*Time expired* _____*Bridge failed* _____ *Load Completely held*

Maximum mass to be supported = 10,000 g.

_____ **g** / _____ **g** = _____

**(mass supported)** **(mass of bridge)** **(Structural Efficiency)**

**Tier (Circle one): 1 2 P DQ** **Final Rank:** _____

(Ties broken by the lowest bridge mass)

# Data Crunchers

1. **DESCRIPTION**: Teams should be able to create and interpret data tables, bar graphs, line graphs, pie charts, and pictographs and perform simple experiments to collect data, graph their results and make predictions.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Measurement & Data is a unifying concept for all grade levels across the Common Core Standards. It also aligns with 5.P.1 and Science as Inquiry in the Essential Standards for all grades. It also aligns with these standards in the mathematics curriculum: NC.4.MD.4, NC.4.NF.2, NC.5.MD.2, NC.6.SP.1-5.

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing utensils.

6. **EVENT LEADERS**: Must provide tests and student response sheets for each team. Event leaders may also provide items such as: rulers, calculators, meter tapes, meter sticks, objects to measure and various types of graphs and data sets to be analyzed.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: Teams will demonstrate understanding of this content in any or all of the following ways:

    a. Collect data with metric measuring devices (length, mass, or volume) and represent that data in a correctly labeled graph or data table.
    b. Plot data points, make and interpret data tables, draw and interpret graphs, including what trends can be predicted from the data shown.
    c. Make estimates of data between or beyond the data points given.
    d. Calculate fractions or percentages based on charts, tables or data.
    e. Calculate the mean, median, and mode for a set of data.
    f. Distinguish between accuracy and precision and identify outliers in a set of data.
    g. Identify types of questions (numerical, categorical, data that changes over time) when collecting data.

10. **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.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Describe It, Build It

1. **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 construct the device from raw materials using their partner's description.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME:** 60 min.

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

6. **EVENT LEADERS**: Will provide paper and all necessary materials.

7. **SAFETY REQUIREMENTS**: None.

8. **IMPOUND**: No

9. **THE COMPETITION**: This event should occur in two rooms so that the builders are not in the same room as the describers while they are writing.

    a. One team member (the describer) is shown an object (which may be abstract) built from, but not limited to, office & craft materials (e.g., straws, push pins, Styrofoam balls, paper cups, Popsicle sticks, paper, stickers, etc.) or commercial sets (e.g., K'nex, Tinker Toys, Legos, Lincoln Logs, etc.). The describer has 25 minutes to write a description of the object and how to build it. There will be no advantage to finishing early. The event leader will notify teams if the color of the pieces does not matter.
    b. Only words and numbers may be used. Symbols, drawings and diagrams are not allowed, with the exception of common punctuation and editing symbols. Printable punctuation marks and/or editing symbols that can be produced on a standard QWERTY keyboard by pressing a single key or a single key in combination with the shift key may be used. These must be used in their normal context and not as symbols to form a key or code.
    c. All abbreviations (not symbols) must be defined either at the beginning or when the abbreviation is first used. (e.g. rt = right)
    d. The event leader will pass the description to the other team member (the builder) who will use the description to create the original object in 20 minutes. Time will be recorded if teams finish early and used as a tiebreaker.

10. **SCORING**:
    a. The team that builds the object most like the original object wins.
    b. Any improper use of symbols, codes or pictures of any kind (including use of words or letters as pictures or codes) will result in the team being placed in a second tier below devices without any writing violations.
    c. Points will be given for each piece of material placed in the proper connection and location compared to the model according to a scoring rubric.
    d. Pieces that are connected correctly beyond an incorrect connection will be counted in the score. No penalty will be assessed for parts that were not used.
    e. Shortest time for the construction phase will be used as a tiebreaker, there is no benefit to finishing the writing portion early.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Genes R Us

1. **DESCRIPTION**: Teams will demonstrate an understanding of traits that may or may not be inherited, be able to explain why organisms share similarities and differences and use Punnett squares to predict inheritance patterns of certain characteristics.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.L.2, 5.L.3

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Teams must bring writing instruments. **Teams may not bring resources to this event.**

6. **EVENT LEADERS**: Event leaders will provide an event with all necessary objects, materials, questions, and response sheets for participants to complete each exam.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will consist of an exam that covers any or all of the following topics.

    a. Define/use the following words: genes, alleles, genotype, phenotype, chromosomes, DNA, homozygous, heterozygous, dominant, and recessive.
    b. Identify life processes or species characteristics that members of a population share and if they are likely inherited (including instinctive behavior) or learned (example: cheetah spots and running ability are inherited while avoidance of hunters is learned).
    c. Understand in general why certain organisms are present in certain habitats, including a basic understanding of adaptation based on inheritance (example: walruses have thick blubber to protect them from hypothermia in arctic habitats).
    d. Identify the following common human inheritable traits and the pattern of inheritance: earlobe attachment, tongue rolling, cleft chin, dimples, ACHOO syndrome and colorblindness.
    e. Make/analyze a Punnett square to determine genotype and phenotype of offspring with known parental genotypes and/or phenotypes (only Mendelian monohybrid crosses).
    f. Understand that dominant alleles mask recessive alleles.

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to preselected questions by the event leader.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Marshmallow Catapult

1. **DESCRIPTION**: Teams will build in advance a device constructed out of specified materials to launch a marshmallow at a target placed on the floor. The goal is to land as close to the center of the target as possible.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.1, 4.P.2, 5.P.1, Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 10 min.

5. **TEAMS:** Teams must bring their catapult and safety glasses.

6. **EVENT LEADERS**: Must provide full-sized Kraft Jet-Puffed marshmallows, score sheets, tape measures, and targets.

7. **SAFETY REQUIREMENTS**: Teams must wear safety glasses throughout the event.

8. **IMPOUND**: Yes, all devices will be impounded prior to any launches.

9. **THE CATAPULT:**
   a. Energy may be provided by one mousetrap (no rat traps) and any number or kind of rubber bands. These must supply all of the energy for launching the marshmallow.
   b. The lever arm and base must be non-metallic. No energy from these should be provided to the launch.
   c. The device must have a trigger or switch that can be activated by a team member using a pencil to start the launch.
   d. No part of the catapult is allowed to be higher than 60 cm from the floor when the launch is triggered.
   e. The entire catapult must be behind the launch line before, during, and after all launches.
   f. Other construction materials may be used, but no sharp objects, liquids, flames, flammable substances, or projectiles will be allowed. Violations will disqualify a catapult.
   g. No part of the device will be allowed to leave the catapult during a launch except the marshmallow. (Violation=Tier 2)
   a. The catapult must be designed and operated in such a way as to not damage the floor. This is easily accomplished with felt or felt pads on the bottom of the device.

10. **COMPETITION**: This event should occur in a large room with a high ceiling.
   a. Only team members and event leaders will be allowed in the event area while teams are competing. Teams cannot receive outside assistance of any kind from anyone once they enter the competition area. Teams violating this rule will be disqualified.
   b. Teams will have a total of 5 minutes to make one launch at each of two targets.
   c. Targets will be placed on the floor between 1.0 m and 5.0 meters from the launch line at 0.5 m increments.
   d. All catapults will be impounded before the target distances are announced.
   e. Team may have 1 practice launch for each distance, but must tell judge that it is a practice before launching.
   f. Target Distances will be measured from the center of the target to where the marshmallow first lands (in cm) NOT where it rolls or finally stops. This is a straight-line distance from marshmallow to target.
   g. If a launch fails, the target distance used will be the entire distance to the target.

10. **SCORING**:
   a. Devices will first be ranked in tiers.
      Tier 1= No violations for building or competition  Tier 2= Violations of rules 9a-e.
      Disqualifications as described in the rules
   b. Target distances of both launches will be added to determine the total score. Lowest total score wins. Within each tier, catapults will be ranked according to the lowest total score.
   c. Ties will be broken by the closest single shot.

11. **EVENT RESOURCES**:
   See the Event Resources tab on our website for instructions, videos and more.

**Marshmallow Catapult Score Sheet – 2021**

School Name: _____Team (Circle One): Varsity JV1 JV2 JV3

Student Names: _____

**<u>Safety Criteria</u>: Teams must wear proper eye protection at all times during launches. No dangerous objects or substances are used. If this criterion is violated, then the device will be disqualified.**

**Are all safety criteria met by the team and device? _____ If yes, continue.**

| | YES | NO |
|---|---|---|
| 1. *The catapult device was properly impounded.* | _____ | _____ |
| 2. *All energy for launches is provided by only one mousetrap and rubberbands.* | _____ | _____ |
| 3. *The team uses a pencil to trigger the launches.* | _____ | _____ |
| 4. *No part of device is higher than 60 cm from floor when in the ready-to-lauch state.* | _____ | _____ |
| 5. *Entire device is behind start line before, during, and after launch.* | _____ | _____ |
| 6. *No part(s) leave device during the launch.** | _____ | _____ |

**If it is determined that the device is dangerous to operate, it will be disqualified and not tested. If this is the case, indicate below.*

***Teams with a "no" checked above will be placed in Tier #2.*** ***Tier = _____***

***Teams with no eye protection or who continue to remove eye protection after warnings will receive participation points only.*** ***Participation only? _____***

***Place an "X" in the blank if safety rules are violated.*** ***Disqualified? _____***

| | **Target Dist.** | **Distance from Target (measured from where marshmallow first hits ground)** |
|---|---|---|
| **<u>Launch #1</u>** | _____ m | _____ cm |
| **<u>Launch #2</u>** | _____ m | _____ cm |

TOTAL for BOTH Launches = _____ (Lowest score wins.)

**Tier (Circle one): 1 2 P DQ** **Final Rank: _____**

# Movers and Shakers

1. **DESCRIPTION:** Teams will be assessed on their knowledge of plate tectonics, earthquakes, volcanoes and related land formations.

2. **ESSENTIAL STANDARDS ALIGNMENT:** 3.E.2

3. **TEAM OF UP TO:** 2

4. **MAXIMUM TIME:** 60 min.

5. **TEAMS**: Each team must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS:** Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam.

7. **SAFETY REQUIREMENTS:** None.

8. **IMPOUND:** No

9. **THE COMPETITION:** The competition will consist of an exam that covers any or all of the following topics.
   a. Features of earthquakes including what they are, where they can occur, why they occur (the underlying mechanism), and how they are measured.
      i. Know how the following terms apply to earthquakes: tectonic plates, epicenter, fault, foreshock, aftershock, seismograph and seismogram, P waves, S waves.
   b. Features of volcanoes including what they are, the parts of the world that have volcanoes, why they erupt (the underlying mechanism), and the impact of eruptions on both humans and the environment.
      i. Know how the following terms apply to volcanoes: geysers, hot spots, hot springs, magma, lava, ash, mudslides, upper mantle, pyroclastic flow, pumice.
      ii. Know the different stages and types of volcanoes
   c. How volcanoes and earthquakes related
   d. The types of landmasses and rocks that are formed from earthquakes and volcanic eruptions.
   e. The theory of plate tectonics, how it works, how it affects earthquakes and volcanoes and what features are formed from the movement of tectonic plates.
   f. Know the location and causes of the Pacific Ring of Fire, the Yellowstone Caldera, the Hawaiian hot spot and the San Andreas Fault.

10. **SCORING:** Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of answers to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES:**
    See the Event Resources tab on our website for instructions, videos and more.

# ProGamers

1. **DESCRIPTION:** Teams of students will use the Scratch 3.0 programming language to recreate a game being shown to them on a screen in the room.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Information & Technology

3. **TEAM OF UP TO:** 2

4. **MAXIMUM TIME:** 50 min.

5. **TEAMS:** Must bring a writing instrument. Teams may also bring two 8.5" x 11" sheets of paper, which must contain only hand written information on both sides of each sheet from any source.

6. **EVENT LEADERS:** Event Leaders will supply logins and passwords for Scratch version 3.0.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND:** No

9. **THE COMPETITION:**
   a. Each team will have their own computer with access to the Scratch website.
   b. Students will log in using accounts created specifically for the tournament.
   c. A pre-programmed game, supplied by the event leader, will play on a continuous loop on a screen in the room.
   d. Students will have 50 minutes to program the game exactly as it is being shown.
   e. Students may be asked to code part of the game using a specific technique (e.g…. use a loop).
   f. Students will make their game public by sharing them with the event leader.

10. **SCORING:**
    a. Points will be awarded for each piece of the code that students are able to successfully program.
    b. Ties will be broken by the team able to successfully program certain pieces of the code in the least amount of time. (predetermined by the event leader).

11. **EVENT RESOURCES:**
    See the Event Resources tab on our website for instructions, videos and more.

# Pump it Up!

1. **DESCRIPTION:** Teams will demonstrate knowledge of the human Circulatory & Respiratory systems.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.L.1, 4.L.2, 5.L.1

3. **TEAM OF UP TO:** 2

4. **MAXIMUM TIME:** 60 min.

5. **TEAMS:** Must bring a writing instrument. No other resources are allowed.

6. **EVENT LEADERS:** Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exams. Examples include but are not limited to models, slides, and pictures.

7. **SAFETY REQUIREMENTS:** None

8. **IMPOUND:** No

9. **THE COMPETITION:** The competition will consist of an exam that covers any or all of the following topics.

    a. Identify the major organs and body parts involved in the respiratory and circulatory systems and understand the important job each body part has:
        i. Heart: ventricles, atrium, aorta, & pathway of blood through the heart
        ii. blood: white blood cells, red blood cells, plasma, & platelets
        iii. vessels: veins, arteries & capillaries
        iv. nose
        v. trachea
        vi. lungs
        vii. diaphragm
    b. Understand how the circulatory and respiratory systems interact with each other and for what purpose.
    c. Understand the following conditions, including the organ or system impacted, basic genetic and/or environmental factors causing the disease, the prevention and treatment for the disease.
        i. Sickle Cell Anemia
        ii. Asthma
        iii. Atherosclerosis
        iv. Cystic Fibrosis
        v. Chronic Obstructive Pulmonary Disease (COPD)
        vi. Lung Cancer

10. **SCORING:** Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES:**
    See the Event Resources tab on our website for instructions, videos and more.

# Ramp and Roll

1. **DESCRIPTION**: Teams will build a ramp and vehicle to travel a certain distance and stop as close to the finish point as possible at the tournament.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.1, 5.P.1, Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: **up to 30 minutes to build** and test before the official scoring.

5. **TEAMS**: Teams MUST bring something to write with, their box full of K'nex materials, and a ramp. **Teams may bring only 1 picture no larger than 8.5" x 11" of their device. This must be 1 picture, not a collage.** No other resources are allowed.

6. **EVENT LEADERS**: Event leaders will provide the score sheets and any measuring devices needed.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: Yes. Teams must drop off the challenge box and the ramp at the time and place specified by the tournament director. The box and ramp must be clearly labeled with the school/team name and team designation (Varsity, JV, etc.). The ramp must have a soft protective covering on the bottom or it cannot be impounded.

9. **THE CHALLENGE BOX**:

   a. All materials and tools for the vehicle must be brought in a box with a lid; the volume of the box with lid in place can be no greater than 33,000 $cm^3$ (example: a common 10 ream copy paper box with the lid on meets this requirement). With all materials and tools in the box, the lid must fit all the way on the box and close completely.
   b. The box must not be used as a part of the device.
   c. Varsity and JV teams from the same or different schools must not share the same challenge box nor materials or tools in the challenge box.
   d. **BUILDING MATERIALS:** Teams may only bring the following building materials:
      i. K'nex pieces. No K'nex motors or other electronic components may be used. No other brands or kinds of building materials may be used. Pieces can't be preassembled in box. Event leaders will disassemble or remove any pieces not allowed by these rules.
      ii. String – any size, brand, or quantity.
      iii. Copy paper, any size.
      iv. Tape, any size or kind.
   e. Teams may organize the box supplies in labeled clear plastic bags or other clear containers. The bags and containers must not be used as building materials.
   g. **TOOLS:** Tools must not be used as part of the device. All tools must also fit within the closed box. Teams may include (any quantity) scissors, rulers, tape measures, and a stopwatch in the box.
   h. Any items that are not allowed will be removed by the event leader at impound and can be picked up after the competition.
   i. Team members must build the device on site using only the materials impounded in their box.

10. **THE CHALLENGE:**

   a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials or communication until they are finished competing. Only participants and event leaders will be allowed in the event area while teams are competing. Teams violating this rule will be disqualified.

# Ramp and Roll, page 2

b. **The Vehicle:** Teams will build on-site a wheeled vehicle powered by gravity (a ramp) to travel either 4.0, 4.5, 5.0, 5.5, or 6.0 meters.
   i. The vehicle must be powered solely by the gravitational energy of rolling down a ramp. No additional sources of energy are allowed.
   ii. Mechanical braking systems that automatically engage are the only type of braking system allowed, if a braking system is used (i.e. no remote controls or tethered stopping system).
   iii. Non-electronic sighting devices are allowed on the vehicle and/or ramp for alignment purposes.
   iv. The vehicle must have a fixed point (e.g. a K'nex piece) extending from the front edge of the vehicle, close to the track surface, that all measurements will be made from.
   v. The vehicle **must be able to transport a golf ball** (provided by event leader before the competition begins).

c. **The Ramp:** Teams will build, in advance, a ramp for their vehicle to roll on. The ramp, with the vehicle in the ready to roll position, must fit within a 60.0 cm x 60.0 cm starting square. There is no height restriction. The ramp MUST have a protective covering on the bottom that will protect the floor from any protruding nails, screws, or other rough edges. Teams without protective material on their ramp will NOT be allowed to compete. The ramp can be built from any materials, not just K'nex.
   i. The ramp must be freestanding and cannot be attached to the floor, walls or held by the students.
   ii. **There must be exactly one clearly labeled Start Line on the ramp and the wheels must touch the start line on the ramp at launch**. The Start Line may not be adjusted after impound and the vehicle must be released from the designated Start Line for all official runs.
   iii. The ramp cannot be adjusted in shape, slope, size, etc during the build and test time.

d. **The Track:** The track must be a relatively smooth, hard surface. The starting box must be marked with tape. A target point will be marked and announced after impound is completed; at either 4.0, 4.5, 5.0, 5.5, or 6.0 meters. A center mark will be made on both the front edge of the starting box and the target point.

e. Structures must be free standing and cannot be attached to a table, floor or any other support.

f. Teams will have a **maximum of 30 minutes** to construct the specified device. Teams must not modify their device after the construction period has ended. Teams that complete construction early may be judged early.

g. The team can practice with their vehicle in their allotted space during the build time.

h. **Official runs:** Teams will be given a 5-minute time period to make 2 official runs.
   i. When the team is ready for official testing, they will carry their vehicle and ramp to the area designated by the event leaders. The students will set up their ramp within the 60cm x 60cm starting square. The team may position the vehicle and ramp in any way as long as the entire structure remains within the square.
   ii. Teams may opt to calibrate and/or adjust their vehicle to achieve the intended distance during the 5-min testing period. **Pieces can be added or removed from the vehicle during the testing period as long as those pieces were impounded.**
   iii. Teams are not allowed to roll the vehicle down the track in advance of the run.
   iv. Teams will do a simple release of the vehicle to start the run, they cannot push the vehicle.
   v. Teams may not chase their vehicle down the track, they must wait until they are called by the event leader to retrieve the vehicle.
   vi. Timing will stop while event leaders make official measurements.

i. Event leaders will measure from the intended stopping point to the fixed point on the front of the vehicle. If there is no fixed point, judges will measure to the center of the front edge of the vehicle.

11. **SCORING**:

a. Teams will be ranked based on the single run where the straight-line distance from the fixed point on the vehicle to the center mark of the finish point is the closest, measured to the nearest tenth of a cm.

b. Teams will be placed in Tiers based on adherence to the challenge instructions. Within each tier, teams will be ranked based on the scoring criteria for the challenge.
   Tier 1: Teams with no violations.
   Tier 2: Teams whose device violates any part of sections 9 or 10.

c. Ties will be broken by the best combined score of both runs.

d. Any team that impounds a box but fails to attempt the build will be considered a "No Show."

13. **EVENT RESOURCES**:

See the Event Resources tab on our website for instructions, videos and more.

**Ramp and Roll Score Sheet – 2021** *(revised 3/26/20)*

**School Name:_____ Team_____ (Circle One): V JV1 JV2 JV3**
**Student Names: _____ _____**

| **Impound Checklist** | |
|---|---|
| The ramp has a protective covering on the bottom to avoid scratching the floor.<br>*If no, students may not impound, send them back to their home base to try and fix the problem* | **Y / N** |
| The box and ramp were impounded on time and are clearly labeled with the school/team name and designation. | **Y / N** |
| All materials for vehicle and tools fit in a box that is no greater than 33,000 $cm^3$ including the lid, which fits all the way on the box and closes completely. | **Y / N** |
| There is a clearly labeled Start Line on the ramp.<br>*If no, allow students to designate one during impound and compete in Tier 1.* | **Y / N** |

*NOTE: Any materials or tools that are not on the approved list will be removed before the competition and given back to the team at a later time. Any pre-assembled materials will be taken apart by the event leaders before the event. No penalty will be assessed for this.*

| **Competition Checklist** | | **Run 1** | **Run 2** |
|---|---|---|---|
| 10.b.i | All energy to propel the vehicle comes from gravitational energy. | **Y / N** | **Y / N** |
| 10.b.ii. | Only a mechanical braking system is allowed (no remote control or tether). | **Y / N** | **Y / N** |
| 10.b.iii. | Only non-electronic sighting devices used. | **Y / N** | **Y / N** |
| 10.b.iv. | Vehicle has a fixed point extending from the front edge. | **Y / N** | **Y / N** |
| 10.c. | Ramp/vehicle in ready to launch position fits within a 60cm x 60cm square. | **Y / N** | **Y / N** |
| 10.c.i. | The ramp is freestanding and not held by the competitors. | **Y / N** | **Y / N** |
| 10.c.ii. | Team did not adjust the ramp after impound. | **Y / N** | **Y / N** |
| 10.c.iii. | Students released vehicle from designated, unaltered start line. | **Y / N** | **Y / N** |
| 10.h.iii. | Team did not roll vehicle to calibrate on the track. | **Y / N** | **Y / N** |
| 10.h.iv. | Team released vehicle without pushing it during release. | **Y / N** | **Y / N** |
| 10.h.v. | Team did not chase vehicle down the track. | **Y / N** | **Y / N** |
| 10.b.v. | Vehicle successfully transported golf ball for entire run. | **Y / N** | **Y / N** |

| | | |
|---|---|---|
| **Straight-line Distance** (distance in cm from fixed point to Target point to nearest 0.10 cm)<br>**Circle best run – low score is best.** | | |
| ***Tier and Penalties:***<br>Tier 1: Run with no violations – all boxes above are a "Yes" for at least 1 run<br>Tier 2: Run with any competition violations – both runs or impound have a "No"<br>DQ: Students continued to work after 30 min time was called or received outside assistance | 1<br>2<br>DQ | |
| ***Final Rank*** | | |

**Low Score wins.**
**The Final Score of a vehicle with one Failed Run must be the other Run Score.**
**Circle lower of 2 Run Scores above. Ties broken by lowest combined run score.**

# Rock Star

1. **DESCRIPTION:** Teams will demonstrate their knowledge of rocks & minerals, the rock cycle and geologic maps.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.E.2, 4.P.2

3. **TEAM OF UP TO:** 2

4. **MAXIMUM TIME:** 60 min.

5. **TEAMS:** Must bring writing instruments. Teams may bring 2 hand lenses and one 3-ring 1" binder containing information in any form from any source. The materials must be 3-hole punched and inserted onto the rings (sheet protectors are allowed). No actual samples may be used in the binder, but photographs and drawings are allowed.

6. **EVENT LEADERS:** Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam.

7. **SAFETY REQUIREMENTS:** Following the handling of rocks and minerals, students should wash their hands.

8. **IMPOUND:** No

9. **THE COMPETITION:** The competition will consist of an exam that covers any or all of the following topics.

   a. Identification of specimens from the Official Rocks & Minerals List
   b. Classification of rocks and minerals by their properties
   c. Information about specimens on the list including, areas of origin, uses and economic importance
   d. Parts and processes of the Rock Cycle
   e. Being able to read a geologic map to find information about rocks and minerals in NC

10. **SCORING:**
    Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES:**
    See the Event Resources tab on our website for instructions, videos and more.

## Official Rocks & Minerals List

| ***Rocks*:** | | ***Minerals*:** | |
|---|---|---|---|
| Basalt | Phyllite | Calcite | Hematite |
| Bituminous coal | Pumice | Copper | Mica-Biotite |
| Conglomerate | Quartzite | Feldspar (pink) | Olivine |
| Gneiss | Sandstone | Fluorite | Pyrite |
| Granite | Scoria | Galena | Kaolinite |
| Limestone (fossil) | Shale | Graphite | Quartz (crystal) |
| Marble | Slate | Gypsum | Talc |
| Obsidian | | Halite | |

# Science Charades

1. **DESCRIPTION**: Team members will take turns acting out and guessing clues for scientific terms or concepts from across all Essential Standards for Elementary Math & Science.

2. **ESSENTIAL STANDARDS ALIGNMENT**: Vocabulary found throughout K-6 Science & Math Essential Standards

3. **TEAM OF UP TO**: 3 (2 is also allowed)

4. **MAXIMUM TIME**: 4 minutes per team.

5. **TEAMS**: Teams must be in groups of 2 or 3 in order to compete in this event. Teams must not bring anything with them to the competition.

6. **EVENT LEADERS**: Will provide supplies needed to test the competitors in this event.

7. **SAFETY REQUIREMENTS**: None.

8. **IMPOUND**: No

9. **THE COMPETITION**:
   a. Teams will have 4 minutes to complete up to 40 terms.
   b. All teams will receive the same terms in the same order. The terms will consist of one or two words coming ONLY from the list provided in these rules.
   c. Team members will alternate acting out and receiving clues. All team members must rotate turns on being the clue actor and guesser. Teams may pick the initial order of rotation. This event requires a minimum of 2 team members to participate.
   d. Timing begins when the judge shows the first team member the first term and ends when the team has correctly identified or passed the last term or when the 4-minute time period has expired. No other team member may see the term.
   e. The actor will then act out the clue. Letters of any alphabet or numbers of any kind are not allowed (it is the intent of this rule to prevent teams from inventing alphabets, codes, etc.). unless they represent the word(s) given, (e.g., a circle for the word sun in a solar eclipse).
   f. The event leader will indicate when the correct term is given. Different forms of the term will not be accepted with the exception of plurals and singulars, which will be accepted interchangeably (e.g. calories or calorie would be accepted).
   g. If a team violates any of the rules regarding the use of verbal or visual communication, the term in play at the time of the violation will be counted as a pass.
   h. Any team member (person giving or receiving clues) may choose to pass on a term. Once the team passes on a term they may not return to it.
   i. When the team has correctly identified or passed on the term, or if a violation occurs, the next team member will be given a new term until the team has gone through their set of terms or the time expires.

10. **SCORING**:
    a. One point will be awarded for each term correctly identified within the allotted time. The team correctly identifying the most terms will be declared the winner.
    b. In the event of a tie, the first tiebreaker is the team with the longest string of consecutively correct words. Second tiebreaker will be teams who identify the first word in the list passed by the other team. Third tiebreaker would be the team with the fewest words passed. The final tiebreaker is the shortest period of time to complete the list. If teams are unable to guess any of the words in 4 minutes, participation points only will be given.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# Science Charades Word List 2021

Abdomen
Absorb
Acid rain
Adapt
Air pressure
Amphibian
Angle
Antenna
Astronomer
Atmosphere
Atom
Balance
Barometer
Biologist
Bird
Boiling point
Botanist
Camouflage
Calorie
Carnivore
Cell
Charge
Chemist
Chew
Chromosome
Circuit
Cleavage
Climate
Clockwise
Cloud
Cold front
Comet
Compass
Compound
Compression
Condensation
Conductor
Constellation
Consumer
Contract
Crater
Current
Cumulus
Cumuli-nimbus
Decay
Decomposer
Degree
Desert
Digestion
Digestive system
Dissolve
DNA
Eardrum
Earthquake
Eclipse
Electricity
Elevation
Endoskeleton
Energy
Engineer
Environment
Equator
Erode
Estimate
Evaporation
Exoskeleton
Expand
Extinct
Fiber
Flight
Float
Flower
Food web
Force
Forest
Fossil
Freeze
Friction
Fungus
Galaxy
Gas
Geologist
Global warming
Gills
Germinate
Grassland
Gravity
Greenhouse effect
Habitat
Heat
Herbivore
Humidity
Humus
Hurricane
Ice
Igneous rock
Insect
Joint
Kidney
Leaf
Lever
Lift
Light
Lightning
Liquid
Magnet
Mammal
Map
Mass
Matter
Measure
Melt
Metamorphic rock
Metamorphosis
Meteor
Meter
Migrate
Mineral
Mixture
Molecule
Moon
Motion
Muscle
Mutualism
Ocean
Omnivore
Orbit
Organ
Organism
Ornithologist
Oxygen
Parallel circuit
Parasite
Pendulum
Photosynthesis
Physicist
Planet
Plateau
Poison
Pole
Pollution
Population
Porous
Prairie
Precipitation
Predator
Prey
Producer
Protein
Pull
Quantity
Quartz
Radiation
Recycle
Repel
Reptile
Resistance
Revolve
River
Rocket
Root
Rotation
Saliva
Screw
Scale
Season
Sedimentary rock
Seed
Series circuit
Shadow
Skin
Soil
Solid
Solution
Sound wave
Space
Spine
Star
Static
Stem
Stomach
Sugar
Sun
Sunset
Taste buds
Teeth
Telescope
Temperature
Thermometer
Thunder
Tornado
Velocity
Vibrate
Volume
Warm front
Waning
Water table
Waxing
Weather
Wheel & axle

# Sky Quest

1. **DESCRIPTION**: Teams will be tested on their knowledge of the solar system. Topics include the sun, moon, planets, rotation and revolution, moon phases, seasons, space exploration missions and identification of constellations/stars/asterisms based on a provided list.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 1.E.1, 3.E.1, 4.E.1, 6.E.1

3. **TEAM OF UP TO**: 2 4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam. Examples include but are not limited to reference charts, posters, and models for the event.

7. **SAFETY REQUIREMENTS**: None 8. **IMPOUND**: No

9. **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. The Earth/Sun relationship including: rotation and revolution, day/night, shadows, and seasons
   b. The Earth/Sun/Moon relationship including: phases and relative positions of all three bodies, tides, and both lunar and solar eclipses
   c. Identification and understanding of the planets in our solar system, how they relate to each other in size, order from the sun, physical properties, and what is unique about each one.
   d. **Space Exploration, including:**
      i. **Robots and Probes**
         - **Rovers on Mars (Sojourner, Spirit, Opportunity, Curiosity, Perseverance)**
         - **Voyager 1 & 2**
         - **Juno**
         - **New Horizons**
      ii. **Human Spaceflight**
         - **Vostok 1**
         - **Freedom 7 & Friendship 7**
         - **Apollo 11**
         - **Space Shuttle program**
   e. Identification of *Major Constellations* ***(Western Starlore)****, their Alpha stars and* ***common Northern Hemisphere asterisms*** from the lists below:

***Major Constellations and their Alpha star in parentheses, if noted:***

| | | | | |
|---|---|---|---|---|
| Aquila (Altair) | Canis Major (Sirius) | Cygnus (Deneb) | Lyra (Vega) | Scorpius (Antares) |
| Aquarius | Canis Minor (Procyon) | Gemini (Castor and | Orion (Betelgeuse) | Taurus (Aldebaran) |
| Aries | Cassiopeia | Hercules | Pegasus | Ursa Major |
| Bootes (Arcturus) | Corona Borealis | Leo (Regulus) | Perseus | Ursa Minor (Polaris) |

**Northern Hemisphere Asterisms:**

| | | | | |
|---|---|---|---|---|
| Big & Little Dippers | Great Square of Pegasus | Orion's Belt | Summer Triangle | Winter Triangle |

10. **SCORING**:
Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**:
See the Event Resources tab on our website for instructions, videos and more.

# Super Sleuths

1. **DESCRIPTION**: Given a mystery scenario, evidence, and a list of possible suspects, teams will be expected to perform a series of tests to draw specific conclusions about the scenario and suspects. The test results along with other evidence will be used to solve the mystery of the scenario.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.2, 4.P.2, Science as Inquiry

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Teams may bring only specified items and goggles. No other items are allowed. The event supervisors will check the kits, and confiscate non-allowed items. **Students not bringing these items will be at a disadvantage. (In-person tournaments only)**
    a. Spot plates, cups, or any containers in which teams can perform the tests
    b. Droppers, popsicle sticks, spatulas, plastic spoons, tongs, and/or forceps for handling materials
    c. pH test strips or pH paper
    d. A ruler
    e. A wash bottle or dropper bottle of distilled water (don't use tap water for this)
    f. Hand lens (aka magnifying glass)
    g. Paper towels
    h. A disposable cup for solid waste
    i. Writing instruments
    j. Safety gear – see rule #7.
    k. Teams may bring one 8.5" x 11" two-sided page of notes containing information in any form from any source.

6. **EVENT LEADERS (in-person tournaments only)**: Event leaders will provide evidence at a central location or pre-organized bags or packets of evidence for each team along with the following:
    a. Iodine reagent (KI solution) Note***: Be sure to check with parents about Iodine allergies before assigning students to this event.***
    b. Vinegar
    c. Isopropyl (rubbing) alcohol
    d. A waste container

    The event leader may provide additional equipment such as microscopes or special demos as the test calls for; instructions on additional equipment will be given if deemed necessary. Flame tests are not permitted.

    *Virtual tournaments will be provided with the results of chemical tests, but no tests may be performed at home during a tournament.*

7. **SAFETY REQUIREMENTS**:
    Students must wear the following or they cannot participate:
    a. Closed-toed shoes
    b. Safety goggles (indirect vent goggles)
    c. Long hair must be tied back
    d. Optional: aprons, gloves, and lab coats

    Students who unsafely remove their safety goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain) will be disqualified from the event.

8. **IMPOUND**: No

# Super Sleuths, page 2

9. **THE COMPETITION**: Teams will be given a scenario that introduces a crime, suspects, and sources of evidence. Teams will perform tests on the evidence to identify the perpetrator of the crime and write up their analysis of the crime.
    a. **Crime Scene Chemical Evidence**:
        i. Powders: Teams will be asked to identify up to 5 of the following powders. There will be no mixtures of powders.

| | | |
|---|---|---|
| baking powder | crystal sugar | sodium acetate |
| baking soda | flour | sodium carbonate |
| borax | non-iodized table salt | vitamin C (ascorbic acid) |
| citric acid | powdered milk | yeast |
| cornstarch | powdered sugar | |

        ii. General Knowledge: Teams will be expected to answer questions about the tests they perform, chemical and physical properties of the powders, and proper lab procedure. Example questions:
            1. If the pH of a substance is 3.5, is it acidic or basic?
            2. What does it mean if a powder turns black in the presence of iodine?
            3. What is the chemical name and chemical formula of table salt?
            4. What is the proper method to smell a chemical?

    b. **Crime Scene Physical Evidence**:
        i. Soil: Participants may be given the composition of soil found at the scene or on the suspects and asked to determine if this implicates any of the suspects.
        ii. Footprints, Shoeprints and Tire treads: Participants may be asked to compare prints and make conclusions such as direction and relative speed of travel. No calculations are expected to be performed.

    c. **Analysis of the Crime**:
        Students will answer questions about which pieces of evidence implicate which suspect and why the suspect was chosen as the culprit, and also why the other suspects were not chosen. They will also answer any other crime scene analysis questions posed by the event supervisor.

10. **SCORING**: The team with the highest score wins. Time will not be used for scoring. The score will be composed of the following elements (percentages given are approximate):
    a. Analysis of chemical evidence 50%, analysis of physical evidence 30%, and analysis of the crime 20%.
    b. Tiebreaker: The highest score on the chemical evidence analysis will break ties.
    c. A 10% penalty may be given if the area is not cleaned up as designated.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website at for instructions, videos and more.

# Weather Permitting

1. **DESCRIPTION**: This event will test the team's knowledge of conducting investigations and using appropriate technology to build an understanding of weather.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.E.1, 5.E.1

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Must bring writing instruments. No other resources are allowed.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will consist of an exam that covers any or all of the following topics.

    a. Water cycle (processes of evaporation, condensation, precipitation, and run-off)
    b. Weather instruments, including thermometer, barometer, rain gauge, hygrometer, sling psychrometer, wind vane, anemometer, weather balloon, radar, and satellite
    c. Types of clouds and their relationships to weather conditions
    d. Weather maps and how they can be used to identify weather conditions
    e. Description of everyday weather during the seasons
    f. Causes of everyday weather
    g. Prevailing and local winds
    h. The jet stream and its effect on local weather
    i. The Gulf stream and its effect on local weather

10. **SCORING**: Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.

# What's the Matter?

1. **DESCRIPTION**: Teams will be assessed on their knowledge of the physical properties of matter and the behavior of solids, liquids, and gases before and after they undergo changes or interactions.

2. **ESSENTIAL STANDARDS ALIGNMENT**: 2.P.2, 3.P.2, 4.P.2, 5.P.2, 6.P.2

3. **TEAM OF UP TO**: 2

4. **MAXIMUM TIME**: 60 min.

5. **TEAMS**: Teams must bring writing instruments and goggles (in-person tournaments only). Teams may not bring resources to this event.

6. **EVENT LEADERS**: Will provide an event with all necessary items, objects, materials, questions, and response sheets for participants to complete exam.

7. **SAFETY REQUIREMENTS**: None

8. **IMPOUND**: No

9. **THE COMPETITION**: The competition will consist of an exam that covers any or all of the following topics.

    a. Understand the size, parts (and their charges) of an atom.
    b. Understand that the behavior of atoms in different states of matter (solid, liquid, gas) regarding shape and volume and relative speed.
    c. Know how to measure and/or calculate volume of a rectangular prism or a liquid in a container.
    d. Be able to measure mass and calculate density.
    e. Understand the concept of relative density and how it can be changed in solids, liquids, and gases.
    f. Differentiate between a solution and a mixture and understand how they can be separated.
    g. Understand the difference between physical and chemical changes and signs that each has taken place.
    h. Understand dissolving and concentration of substances such as food dye, salt, and sugar in water, and the factors that affect solubility such as stirring and heat.
    i. Observe or test for other properties of matter: magnetism, flexibility, hardness, opacity, strength, viscosity (runniness), and buoyancy.

10. **SCORING**:
    Points will be awarded for the accuracy of responses. Ties will be broken by the accuracy or quality of responses to pre-selected questions chosen by the event leader.

11. **EVENT RESOURCES**:
    See the Event Resources tab on our website for instructions, videos and more.