



North Carolina Science Olympiad

2020 Event Manual

Division A

North Carolina Science Olympiad ©2020

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 slightly different. ***Be sure to check your tournament webpage for your exact schedule.***

Proposed 2020 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! (self-schedule, choose 1 period)
	Backyard Biologist
	Body Builders
	Describe It, Build It
	Duct Tape Challenge
	Metric Mania
	Weather Permitting
Period 2 (10:20 am - 11:30 am)	3,2,1 Blast Off! (self-schedule, choose 1 period)
	Pasta Tower (self-schedule, choose 1 period)
	Planet Protectors
Impound by 8:30	Ramp and Roll
	Sky Quest
	Science Headbands
	Super Sleuths
Period 3 (11:40 am - 12:50 pm)	Pasta Tower (self-schedule, choose 1 period)
	Data Crunchers
	Ecology Experts
	Energy Matters
	Fossil Frenzy
	Codebusters (trial in some regions)
	ProGamers
1:00 - 1:45 pm	Lunch
1:45 – 2:15 pm	Closing/Awards Ceremony

2020 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.

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 2020, the focus will be on trees, amphibians & reptiles. Teams will be required to identify organisms from a provided list and know about the habitat and conditions required for growth of the organisms.

Body Builders (3.L.1, 4.L.2, 5.L.1)

Teams will demonstrate knowledge of the major systems of the human body in terms of their functions necessary for human life.

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.

Duct Tape Challenge (Science as Inquiry)

Teams will arrive at the competition and be given a set of materials, including Duct Tape, and a task. They will then have a given amount of time to complete whatever task they are assigned, such as building the tallest tower, widest bridge, most buoyant boat, etc. The task parameters will be clearly outlined for the teams. At the end of the build time, teams will test their structures to determine the winner.

Ecology Experts (3.E.2, 4.P.1, 5.L.2, 6.L.2)

Teams will be assessed on their knowledge of Deserts, Grasslands, & Forest ecosystems and biomes. Topics include but are not limited to the ecology of the biomes and the roles and interactions of living and nonliving things within them.

Energy Matters (3.P.2, 3.P.3, 4.P.1, 4.P.2, 4.P.3, 5.P.2, 5.P.3)

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 as well as energy forms, transfer of energy, physical changes, and changes in states of matter due to heating and cooling.

Fossil Frenzy (4.E.2)

Teams will be assessed on their knowledge of geologic time, fossils, dinosaurs, and the fossilization process.

Metric Mania (Measurement & Data, Geometry)

Teams will demonstrate their understanding of metric measurement by estimating and measuring length, mass, fluid volume, angles, and temperature and be able to make calculations based on these measurements.

Pasta Tower (Science as Inquiry)

The objective of this event is to design and build a tower, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg.

Planet Protectors (1.L.1, 4.L.1)

Teams will be assessed on their knowledge of human interaction with the earth, including interacting positively and negatively with the environment, resource use, and consequences of these interactions.

ProGamers (Information & Technology)

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.

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 as possible at the tournament.

Science Headbands (Science as Inquiry)

Team members will take turns asking questions to guess 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)

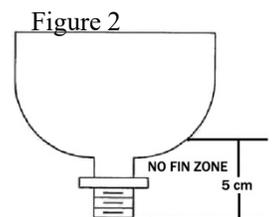
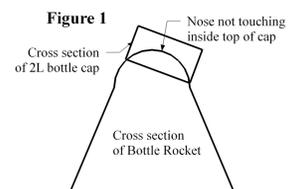
Given a mystery scenario, evidence, and a list of possible suspects, teams will be expected to perform a series of tests to draw specific conclusions about the scenario and suspects. The test results along with other evidence will be used to solve the mystery of the scenario.

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 **Severe Storms**.

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 2020, 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.*



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- 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 table tennis 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, provided that it does not violate any other rule and is deemed safe.

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 at www.sciencenc.com for instructions, videos and more.

3,2,1 Blast Off! 2020 Score Sheet *(revised 8/1/19)*

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

Student Names: _____

ROCKET 1	ROCKET 2
Safety Criteria	Safety Criteria
<p>_____ 9.a. Used 2-liter plastic carbonated beverage bottle.</p> <p>_____ 9.a.i. Teams presented labels if removed from pressure vessel or label was still on bottle.</p> <p>_____ 9.a.iii. Structural integrity of pressure vessel unaltered (no cutting, sanding, using any glues on <i>pressure vessel</i>).</p> <p>_____ 9.b. No metal parts anywhere on rocket.</p> <p>_____ 9.b. No commercial rockets or parts.</p> <p>_____ 9.c. Rocket has a blunt or rounded nose.</p> <p>_____ 9.e. Only water/air used at launch.</p> <p>_____ 9.f. Recovery system is safe.</p> <p>_____ 7. Wearing Z87+ impact rated safety glasses or impact rated goggles at all times (one warning ok).</p>	<p>_____ 9.a. Used 2-liter plastic carbonated beverage bottle.</p> <p>_____ 9.a.i. Teams presented labels if removed from pressure vessel or label was still on bottle.</p> <p>_____ 9.a.iii. Structural integrity of pressure vessel unaltered. (no cutting, sanding, using any glues on <i>pressure vessel</i>).</p> <p>_____ 9.b. No metal parts anywhere on rocket.</p> <p>_____ 9.b. No commercial rockets or parts.</p> <p>_____ 9.c. Rocket has a blunt or rounded nose.</p> <p>_____ 9.e. Only water/air used at launch.</p> <p>_____ 9.f. Recovery system is safe.</p> <p>_____ 7. Wearing Z87+ impact rated safety glasses or impact rated goggles at all times (one warning ok).</p>
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
<p>_____ 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.</p> <p>_____ 10.h. Ping Pong Ball is launched with rocket. If no, then Tier 2.</p> <p>_____ 10.g. Ping Pong Ball separates from rocket. If no, then Tier 2.</p>	<p>_____ 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.</p> <p>_____ 10.h. Ping Pong Ball is launched with rocket. If no, then Tier 2.</p> <p>_____ 10.g. Ping Pong Ball separates from rocket. If no, then Tier 2.</p>
Rocket 1 Time Aloft (sec) Record all times. <i>(Time until ping pong ball lands)</i>	Rocket 2 Time Aloft (sec) Record all times <i>(Time until ping pong ball lands)</i>
(Use time from middle of 3 timers): _____	(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.

Backyard Biologist

1. **DESCRIPTION**: Teams will be assessed on their knowledge of living organisms that they may encounter in their own backyard. **In 2020, the focus will be on trees, amphibians & reptiles.** 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. Teams may also bring up to two hand lenses.
6. **EVENT LEADERS**: Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations. 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**: This event will be run in a station format. Teams will rotate through stations that assess 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. Basic properties (capacity to hold water) and components (sand, clay, and humus) of soil and how these determine the ability of soil to support the growth of many plants.
 - ii. 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. Reptiles and amphibians
 - 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 at www.sciencenc.com for instructions, videos and more.

Backyard Biologist – 2020 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.

<p>Trees (Identify by leaves, bark, and seeds):</p> <p>American beech (<i>Fagus grandifolia</i>) American elm (<i>Ulmus Americana</i>) Bitternut hickory (<i>Carya cordiformis</i>) Black cherry (<i>Prunus serotina</i>) Black Oak (<i>Quercus velutina</i>) Black Willow (<i>Salix nigra</i>) Eastern Cottonwood (<i>Populus deltoids</i>) Eastern white pine (<i>Pinus strobus</i>) Flowering dogwood (<i>Cornus florida</i>) * Southern Live Oak (<i>Quercus virginiana</i>) Loblolly pine (<i>Pinus taeda</i>)** Longleaf pine (<i>Pinus palustris</i>)** Pecan (<i>Carya illinoensis</i>) Red maple (<i>Acer rubrum</i>) River Birch (<i>Betula nigra</i>) Shortleaf pine (<i>Pinus echinata</i>)** Southern red oak (<i>Quercus falcate</i>) Sweet gum (<i>Liquidambar styraciflua</i>) Tulip/yellow poplar (<i>Liriodendron tulipifera</i>) White Oak (<i>Quercus alba</i>)</p> <p>* State Symbol ** Pine trees (generic) are the NC state tree</p>	<p>REPTILES</p> <p>Alligators - Order Crocodylia American Alligator (<i>Alligator mississippiensis</i>)</p> <p>Lizards - Order Squamata: Sauria (Lacertilia) Green Anole (<i>Anolis carolinensis</i>) Southeastern Five-lined Skink (<i>Eumceces inexpectatus</i>) Eastern Glass Lizard (<i>Ophisaurus ventralis</i>) Eastern Fence Lizard (<i>Sceloporus undulatus</i>)</p> <p>Snakes - Order Squamata: Serpentes Copperhead (<i>Agkistrodon contortrix</i>) Cottonmouth (<i>Agkistrodon piscivorus</i>) Brown Snake (<i>Storeria dekayi</i>) Eastern Diamondback Rattlesnake (<i>Crotalus adamanteus</i>) Black Rat Snake (<i>Elaphe obsoleta obsoleta</i>) Eastern Hognose Snake (<i>Heterodon platirhinos</i>) Eastern Kingsnake (<i>Lampropeltis getula getula</i>) Banded Water Snake (<i>Nerodia fasciata</i>) Eastern Garter Snake (<i>Thamnophis sirtalis sirtalis</i>)</p> <p>Turtles - Order Testudines Snapping Turtle (<i>Chelydra serpentina</i>) Painted Turtle (<i>Chrysemys picta</i>) Spotted Turtle (<i>Clemmys guttata</i>) Eastern Box Turtle (<i>Terrapene carolina carolina</i>)* Yellow-bellied Slider (<i>Trachemys scripta</i>)</p> <p>AMPHIBIANS</p> <p>Frogs and Toads - Order Anura American Toad (<i>Bufo americanus</i>) Pine Barrens Treefrog (<i>Hyla andersonii</i>)* Bullfrog (<i>Rana catesbeiana</i>) Southern Leopard Frog (<i>Rana sphenoccephala</i>)</p> <p>Salamanders - Order Caudata Marbled Salamander (<i>Ambystoma opacum</i>)* Red-backed Salamander (<i>Plethodon cinereus</i>) White-spotted Slimy Salamander (<i>Plethodon cylindraceus</i>)</p>
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Body Builders

1. **DESCRIPTION:** Teams will demonstrate knowledge of the major systems of the human body in terms of their functions necessary for human life.
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.
6. **EVENT LEADERS:** Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations. Examples include but are not limited to: models, slides, and pictures.
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 major organs and body parts involved in each of the following systems including the important job each body part has:
 - i. The Circulatory System: heart, blood vessels, blood
 - ii. The Digestive System: mouth, esophagus, stomach, small intestine, large intestine
 - iii. The Endocrine System: (function only)
 - iv. The Immune System: (function only)
 - v. The Muscular System: cardiac, skeletal, smooth muscles (functions, not individual muscles)
 - vi. The Respiratory System: nose, trachea, lungs
 - vii. The Skeletal System: (functions, not individual bones)
 - viii. The Nervous System: brain, spinal cord, nerves
 - b. How the systems work together to maintain health and fitness.
 - c. How to care for each system.
 - d. The role vitamins and minerals play in keeping a body healthy.
 - e. Major disorders associated with each system.
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 at www.sciencenc.com for instructions, videos and more.

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**: This event will be run in a station format. Teams will demonstrate understanding in any or all of the following ways:
 - a. Collect data (e.g. number of water drops various coins can hold) 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 at www.sciencenc.com 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 at www.sciencenc.com for instructions, videos and more.

Duct Tape Challenge

1. **DESCRIPTION:** Teams will arrive at the competition and be given a set of materials, including Duct Tape, and a task. They will then have a given amount of time to complete whatever task they are assigned, such as building the tallest tower, widest bridge, most buoyant boat, etc. The task parameters will be clearly outlined for the teams. At the end of the build time, teams will test their structures to determine the winner.
2. **ESSENTIAL STANDARDS ALIGNMENT:** Science as Inquiry
3. **TEAM OF UP TO:** 2 4. **MAXIMUM TIME:** 50 min.
5. **TEAMS:** Teams must bring something to write with and may also bring a ruler, scissors, and a stopwatch.
6. **EVENT LEADERS:** Will provide challenge instructions and all materials needed for the event.
7. **SAFETY REQUIREMENTS:** None.
8. **IMPOUND:** No
9. **THE COMPETITION:**
 - a. **LOCATION:** This event should occur in a large room or in multiple rooms at the same time. As much as possible, teams should be given the same type of area to build (e.g. space on the floor, flat desktop). Students may not stand on tables or chairs to construct their devices.
 - b. **MATERIALS:** Each team will be given the exact same type and quantity of materials, including a Shurtape-brand duct tape. Examples of supplemental materials may be: styrofoam bowls, drinking straws, paper clips, cups, string, paper, and popsicle sticks. Materials are not limited to this list. The actual materials provided may be entirely different. Only those materials given to the competitors may be used to build the structure.
 - c. **TASK:** The event leader will provide task instructions that identify the task to complete. The instructions will not be released until the beginning of the competition. Example tasks are: a parachute that descends the slowest, longest bridge span to support a tennis ball without sagging, lightest boat that holds the most weight, tallest sail that stands up to a fan, longest/highest/slowest ramp to deliver a ball to a destination, plane that flies the furthest/longest, etc. Tasks are not limited to this list.
 - d. **TIME:** The team of students will have a maximum of 35 minutes to complete the specified task. The remainder of the time will be used for judging.
 - e. **ATTACHMENT:** Unless specifically stated in the task instructions, devices must be freestanding and may not be attached to a tabletop, floor, ceiling or other support.
10. **SCORING:**
 - a. Devices will be judged according to the guidelines set forth by the event leader. The dimensions specified in the task instructions will be measured and recorded as accurately as possible by the event leader.
 - b. At the event leader's discretion, devices that are required to accomplish a task (e.g. support a load for so many seconds) may either be given an assigned number of points for completing the task, or be tiered so that all devices completing the task rank above those that do not. This must be specified in the task instruction sheet.
11. **EVENT RESOURCES:**

See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.



This event is supported by Shurtape Technologies, LLC

Ecology Expert

1. **DESCRIPTION:** Teams will be assessed on their knowledge of Deserts, Grasslands, & Forest ecosystems and biomes. Topics include but are not limited to the ecology of the biomes and the roles and interactions of living and nonliving things within them.
2. **ESSENTIAL STANDARDS ALIGNMENT:** 1.L.1, 1.L.2, 1.E.2, 3.E.2, 4.L.1, 5.L.2, 6.L.2
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 a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations.
7. **SAFETY REQUIREMENTS:** None.
8. **IMPOUND:** No
9. **THE COMPETITION:** This event will be run in a station format. Teams will rotate through stations with questions, models, pictures, diagrams, and maps that assess any or all of the following topics:
 - a. The following ecosystems and biomes:
 - i. Desert: Coastal, Hot and dry, Semiarid (NOTE: cold deserts will not be covered, as they are grouped with arctic)
 - ii. Grassland: Savanna, Temperate
 - iii. Forest: Temperate, Taiga, Tropical
 - b. Components of desert, grassland, and forest ecosystems and biomes.
 - i. Location on earth
 - ii. Biotic and abiotic components
 - iii. Adaptations of organisms that live in the biome
 - c. The functions of organisms within each ecosystem and biome.
 - i. Producers
 - ii. Consumers
 - iii. Decomposers
 - d. The physical characteristics of each biome.
 - i. Climate
 - ii. Soil Nutrients
 - iii. Amount of sunlight
 - e. The interaction of organisms within an ecosystem.
 - i. Food chains & webs
 - ii. Trophic levels
 - iii. Predator/prey interaction
 - iv. Symbiotic relationships: mutualism, commensalism, parasitism
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 at www.sciencenc.com for instructions, videos and more.

Energy Matters

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 as well as energy forms, transfer of energy, physical changes, and changes in states of matter due to heating and cooling.
2. **ESSENTIAL STANDARDS ALIGNMENT**: 3.P.2, 3.P.3, 4.P.1, 4.P.2, 4.P.3, 5.P.2, 5.P.3, 6.P.2, 6.P.3.
3. **TEAM OF UP TO**: 2
4. **MAXIMUM TIME**: 50 min.
5. **TEAMS**: Teams must bring writing instruments and goggles. Teams may not bring other resources to this event.
6. **EVENT LEADERS**: Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations.
7. **SAFETY REQUIREMENTS**: Goggles
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. There will likely be a hands-on lab portion to this event.
 - a. The sizes, charges, and parts of an atom.
 - b. The behavior of atoms in different states of matter (solid, liquid, gas) regarding shape, volume, and relative speed of the atoms.
 - c. The concept of relative density and how it can be changed in solids, liquids, and gases.
 - d. The properties of matter to include: attraction to magnets, flexibility, conductivity of heat and/or electricity, strength, and reaction to water.
 - e. How substances can change when they are heated or cooled.
 - f. Given a description or demonstration, be able to explain whether a chemical or physical change has occurred based on the properties of the original and new materials.
 - g. The basic forms of energy and how they travel: electrical, heat, light, magnetic, and sound.
 - h. The basic forms of energy and how can be converted from form to another: electrical, heat, light, magnetic, and sound.
 - i. How energy can be transferred from one object to another (conduction, convection, friction, radiation).
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 at www.sciencenc.com for instructions, videos and more.

Fossil Frenzy

1. **DESCRIPTION:** Teams will be assessed on their knowledge of geologic time, fossils, dinosaurs, and the fossilization process.
2. **ESSENTIAL STANDARD ALIGNMENT:** 4.E.2
3. **TEAM OF UP TO:** 2
4. **MAXIMUM TIME:** 60 min.
5. **TEAMS:** Must bring writing instruments. Teams may bring one 8.5” x 11” two-sided page of notes containing information in any form from any source.
6. **EVENT LEADERS:** Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations.
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. Be able to identify conditions required for a plant or an animal to become fossilized.
 - b. Be able to distinguish between modes of preservation: petrification, mineral replacement, cast/mold, imprint, encasement in amber/copal, mummification, freezing, entrapment in tar/asphalt.
 - c. Be able to make inferences about dinosaurs from footprints, teeth, body structures and coprolites.
 - d. Understand the Geologic Time Scale and be able to distinguish between era, period, and epoch and know where the dinosaurs and humans fit in on that time scale.
 - e. Identification of specimens on the Official Dinosaur and Fossil List from pictures, replicas, actual specimens, descriptions, etc.
 - f. Identification of the geologic time period (Triassic, Jurassic, or Cretaceous) each dinosaur on the Official List is from.
 - g. Be able to distinguish between carnivores, herbivores, and omnivores when given evidence based on jaws, teeth, footprints, etc.
 - h. Be able to distinguish the type of environment: marine, terrestrial, fresh water, etc. for all species listed on the Official Fossil List or when given clues from the fossil record.
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 at www.sciencenc.com for instructions, videos and more.

2020 Official Fossil and Dinosaur List
Students will have to know common names only!

INVERTEBRATES

Corals
Trilobites
Crustaceans (shrimp, lobster, crabs, barnacles)
Brachiopods
Bivalves (Clams, mussels, oysters)
Cephalopods (nautiloids, ammonoids, belemnoids)
Echinoids (sea urchins, sand dollars)
Asteroids (sea stars, brittle stars)

VERTEBRATES

Fish
Sharks (*Shark Teeth) and rays
Bony Fish *Osteichthyans
Ichthyosaurs
Plesiosaurs
Pterosaurs

Dinosaurs

Acrocanthosaurus
Allosaurus
Ankylosaurus
Apatosaurus
Archaeopteryx
Coelophysis
Deinonychus
Diplodocus
Parasaurolophus
Plateosaurus
Velociraptor
Tyrannosaurus rex
Iguanodon
Stegosaurus
Triceratops

TRACE FOSSILS

Trails, Borings
Tracks, Trackways
Burrows, Tubes
Coprolites

OTHER

Amber
*Petritified wood

Metric Mania

1. **DESCRIPTION**: Teams will demonstrate their understanding of metric measurement by estimating and measuring length, mass, fluid volume, angles, and temperature and be able to make calculations based on these measurements.
2. **ESSENTIAL STANDARDS ALIGNMENT**: Measurement & Data and Geometry are unifying concepts for all grade levels across the Common Core Standards.
3. **TEAM OF UP TO**: 2
4. **MAXIMUM TIME**: 60 min.
5. **TEAMS**: Must bring NOTHING to the competition, writing instruments will be provided.
6. **EVENT LEADERS**: Must provide writing instruments and student response sheets for each team. Event leaders may also provide items such as: rulers, calculators, protractors, meter tapes, meter sticks, electronic and/or triple beam balances, beakers, Erlenmeyer flasks, graduated cylinders, thermometers, calipers, and objects to measure.
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. Estimation or measurement of the angle degree, mass, volume, length, area, or temperature of various objects in metric units to the precision requested.
 - b. Understanding of the relative scale of metric units and which is appropriate for measurement (mg, g, kg, mm, cm, m, km, mL, L, kL, °C, K, cm², cm³) in different scenarios.
 - c. Identification of lines and angles and classification of shapes by the properties of their lines and angles.
 - d. Understanding of how to measure and calculate the volume of a rectangular prism, a liquid in a container, or an irregularly shaped object given water and a graduated cylinder.
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 at www.sciencenc.com for instructions, videos and more.

Pasta Tower

1. **DESCRIPTION:** The objective of this event is to design and build a tower, constructed only of pasta and glue, with the greatest structural efficiency, capable of supporting a load of up to 10 kg.
2. **ESSENTIAL STANDARDS ALIGNMENT:** Science as Inquiry
3. **TEAM OF UP TO:** 2
4. **MAXIMUM TIME:** 10 min.
5. **TEAMS:** Teams must bring tower 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 flat surface testing platform with a 20.0 cm x 20.0 cm square opening in its center.
 - 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 tower by the team during testing and used to suspend the bucket and sand beneath the tower.
 - c. An electronic balance or scale that can mass up to 12 kg (the “sand scale”) and one that can mass a tower up to 400 g to the nearest .1 g (the “tower scale”). Towers exceeding the capacity of the tower 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 Z87+ safety glasses throughout event.
8. **IMPOUND:** None
9. **CONSTRUCTION:**
 - a. Prior to the tournament, participants will construct a pasta tower that is a single structure at least **35.0 cm** tall, constructed only of pasta and glue. No other materials may be used. There is no maximum height. Homemade pasta is allowed, but additional ingredients, such as metal fibers, cannot be added to the dough.
 - b. The pasta tower must be built so that a 5.0 cm long x 5.0 cm wide x 2.0 cm (+/- 0.1 cm) thick square loading block may be placed on top of it. All parts of the loading block must be a minimum of 35.0 cm above the testing platform before the load is applied. The loading block must be supported so that a chain, suspended from its center, can be threaded through the middle of the tower so that it is within 2.5 cm of the center of the opening in the testing platform. Towers should be constructed to ensure the chain does not contact the tower at any point.
 - c. Towers must be able to span the **20.0 cm x 20.0 cm** opening on the testing platform.
 - d. No portion of the tower may extend below the top surface of the testing platform.



Loading Block & Chain

Pasta Tower, page 2

10. THE COMPETITION:

- 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 towers must be measured and weighed prior to testing.
- c. Teams must strive to handle the tower themselves throughout the process of measuring and loading. Event leaders should only handle towers as a last resort.
- d. Teams must place the tower on the testing platform themselves so that the corners of the tower rest on the top surfaces of the testing platform.
- e. Teams will place the loading block on the tower at the top center, 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 tower are positioned.
- g. Loading must stop when failure of the tower occurs, when the maximum load of 10 kg is supported, or when the time expires, whichever occurs first. Failure is defined as the inability of the tower to support additional load, or something other than the tower is supporting the load (i.e., the tower leans and chain touches edge of platform, or sags enough that the bucket touches ground, or part of the tower 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 that falls 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. SCORING:

- a. The best structural efficiency (highest number) wins, determined by the following equation:
$$\text{Structural Efficiency} = \text{Load Supported (grams)} \div \text{Mass of Tower (grams)}$$
- b. Towers that hold more than 10 kg will be scored using 10 kg (10,000 g) as the maximum Load Supported.
- c. Towers will be scored in 2 tiers:
Tier 1: Towers with no violations
Tier 2: Towers with construction violations
Towers 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 tower, then the tallest tower if a second tiebreaker is needed.

12. RESOURCES:

See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.

Pasta Tower Score Sheet – 2020 *(revised 6/20/19)*

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

Student Names: _____

Safety Criteria: Teams must wear proper eye protection at all times during launches. No dangerous objects or substances are used. If this criteria is violated, then the device can not be tested.

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

Mass of tower: _____ g	Height of the Tower (tiebreaker) _____		YES	NO
1. <i>The tower is to be a single structure constructed ONLY of pasta and glue.</i>		_____	_____	_____
2. <i>The tower is free standing and spans a 20.0 cm opening while resting on top of the testing platform.</i>		_____	_____	_____
3. <i>The tower is \geq 35.0 cm in height.</i>		_____	_____	_____
4. <i>The tower does not extend below the top of the testing platform when unloaded.</i>		_____	_____	_____
5. <i>The tower supports the loading block and chain assembly at the center of the top and allows chain to hang freely.</i>		_____	_____	_____

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 _____ Tower failed _____ Load held

Maximum mass to be supported = 10,000 g.

$$\frac{\text{_____ g}}{\text{(mass supported)}} \div \frac{\text{_____ g}}{\text{(mass of tower)}} = \frac{\text{_____}}{\text{(Structural Efficiency)}}$$

Tier (Circle one): 1 2 P DQ **Final Rank:** _____
 (Ties broken by the lowest tower mass, then by the tallest tower if needed)

Planet Protectors

1. **DESCRIPTION:** Teams will be assessed on their knowledge of human interaction with the earth, including interacting positively and negatively with the environment, resource use, and consequences of these interactions.
2. **ESSENTIAL STANDARDS ALIGNMENT:** 1.L.1, 4.L.1
3. **TEAM OF UP TO:** 2
4. **MAXIMUM TIME:** 60 min.
5. **TEAMS:** Must bring writing instruments and safety goggles.
6. **EVENT LEADERS:** Will provide a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations.
7. **SAFETY REQUIREMENTS:** Safety Goggles (indirect vent goggles)
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. **There may be a hands-on lab portion to this event.**
 - a. Helpful interactions with the earth such as reducing, reusing, repurposing, recycling, or composting.
 - b. Harmful interactions with the earth such as strip mining, deforestation, overconsumption, overpopulation, and bycatching.
 - c. Renewable vs. non-renewable resources.
 - d. Energy sources: Coal, Petroleum, Nuclear, Solar, Wind, Wave, Geothermal, Biomass, and Hydroelectric.
 - e. Point and non-point pollution including air, water, groundwater, noise, and light.
 - f. Best practices for conservation and pollution prevention.
 - g. Consequences of not using best practices, especially the Great Pacific Garbage Patch, ozone layer depletion, ocean acidification, loss of biodiversity, and climate change.
 - h. Air quality index ratings and their impact on individual's health.
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 at www.sciencenc.com 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 & Techonology
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:** Will provide computers with internet access to the site <https://scratch.mit.edu/>, and a projector and screen to show the game that the students need to try and create. Event Leaders will also 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.
 - g. Students will raise their hand as each section is finished for the event leader to check off the tasks completed.
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 at www.sciencenc.com for instructions, videos and more.
www.youngengineersoftoday.com
www.code.org
<https://scratch.mit.edu/>

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 cm³ (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.
- The vehicle must be powered solely by the gravitational energy of rolling down a ramp. No additional sources of energy are allowed.
 - 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).
 - Non-electronic sighting devices are allowed on the vehicle and/or ramp for alignment purposes.
 - 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.
 - 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.
- The ramp must be freestanding and cannot be attached to the floor, walls or held by the students.
 - There must be exactly one clearly labeled Start Line on the ramp.** The Start Line may not be adjusted after impound and the vehicle must be released from the designated Start Line for all official runs.
 - 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.
- 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.
 - 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.**
 - Teams are not allowed to roll the vehicle down the track in advance of the run.
 - Teams will do a simple release of the vehicle to start the run, they cannot push the vehicle.
 - Teams may not chase their vehicle down the track, they must wait until they are called by the event leader to retrieve the vehicle.
 - 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:**
- 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.
 - 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.
 - Ties will be broken by the best combined score of both runs.
 - Any team that impounds a box but fails to attempt the build will be considered a "No Show."
12. **RESOURCES:** See the Event Resources tab on our website at www.sciencenc.com for instructions, videos and more.

Ramp and Roll Score Sheet – 2020 (revised 8/1/19)

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. <i>If no, students may not impound, send them back to their home base to try and fix the problem</i>	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. <i>If no, allow students to designate one during impound and compete in Tier 1.</i>	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) Circle best run – low score is best.		
Tier and Penalties: Tier 1: Run with no violations – all boxes above are a “Yes” for at least 1 run Tier 2: Run with any competition violations – both runs or impound have a “No” DQ: Students continued to work after 30 min time was called or received outside assistance	1 2 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.

Science Headbands

1. **DESCRIPTION:** Team members will take turns asking questions to guess 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 bring a writing utensil to the competition.
6. **EVENT LEADERS:** Will provide stopwatches, 40 words printed on index cards, score sheets, and paper headbands.
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 asking questions and giving answers. All team members must rotate turns on asking questions and giving yes or no answers. Teams may pick the initial order of rotation. This event requires a minimum of 2 team members to participate.
 - d. The competition begins with team members putting a card on their headband clip. Their partners can see the word, but they cannot see the word they are wearing. Timing begins when the team member wearing word #1 asks the first question and ends when the team member has correctly identified the last term, has passed on the last term or when the 4-minute time period has expired, whichever occurs first.
 - e. The team member guessing the term must ask yes or no questions and their teammates must answer using only “Yes” or “No.”
 - f. Participants may not give visual clues with their hands or bodies except for event leader demonstrated clues such as nodding yes or no.
 - g. 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).
 - h. 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.
 - i. Any team member (person guessing or those answering) may choose to pass on a term. Once the team passes on a term they may not return to it.
 - j. 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, whichever happens first.
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. The second tiebreaker will be the team who identified the first word in the list passed by the other team. The third tiebreaker will 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 at www.sciencenc.com for instructions, videos and more. This includes a digital list of the words that can be printed.

Science Headbands Word List 2020

Abdomen	Computer	Galaxy	Neutron	Season
Acid rain	Constellation	Gas	Nuclear Engineer	Sedimentary rock
Air	Consumer	Geologist	Ocean	Seed
Amphibian	Crater	Global warming	Omnivore	Shadow
Angle	Crime Scene Investigator	Gram	Orbit	Skin
Architect	Crop	Graph	Organ	Software Developer
Arctic	Cumulus Cloud	Gravity	Organism	Soil
Astronaut	Current	Habitat	Ornithologist	Solid
Astronomer	Data Scientist	Heat	Oxygen	Sound wave
Atmosphere	Decomposer	Herbivore	Paleontologist	Space
Atom	Degree	Humidity	Parasite	Spinal cord
Autumn	Desert	Humus	Pattern	Spine
Axis	Digestive system	Hurricane	Pendulum	Star
Barometer	Eardrum	Ice	Physicist	Static Electricity
Bedrock	Earth	Igneous rock	Planet	Stem
Biologist	Earthquake	Insect	Plastic	Stomach
Bird	Eclipse	Jet stream	Pole	Sugar
Blood	Egg	Joint	Pollen	Sun
Bone	Electrical Engineer	Lake	Pollution	Sunrise
Botanist	Electricity	Leaf	Population	Sunset
Brake	Electron	Light	Precipitation	Tadpole
Calorie	Endoskeleton	Lightning	Predator	Teeth
Camouflage	Energy	Liquid	Prey	Telescope
Carnivore	Entomologist	Magnet	Producer	Temperature
Cast	Environment	Mammal	Protein	Thermometer
Cell	Equator	Map	Proton	Thunder
Chemist	Estuary	Mass	Radiation	Topsoil
Circuit	Exoskeleton	Matter	Rain Forest	Tornado
Civil Engineer	Fertilizer	Metamorphic rock	Ramp	Veterinarian
Clay	Flower	Meteor	Reptile	Vitamin
Climate	Food Scientist	Meter	River	Waning Moon
Cloud	Food web	Mineral	Rocket	Warm front
Coast	Force	Mixture	Root	Waste
Cold front	Forest	Mold	Saliva	Water table
Comet	Fossil	Molecule	Sand	Waxing Moon
Compass	Freshwater	Moon	Savanna	Weather
Compound	Fungus	Muscle	Scale	Zoologist

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 a hands-on event with all necessary items, objects, materials, questions, and response sheets for participants to complete stations. Examples include but are not limited to: reference charts, posters, and models for 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)
 - 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
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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 at www.sciencenc.com 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.**
 - 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**: 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 containerThe 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.
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 coatsStudents 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 www.sciencenc.com 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 **Severe Storms**.
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 a hands-on event with all necessary items, maps, charts, data sets, materials, questions, and response sheets for participants to complete stations.
7. **SAFETY REQUIREMENTS**: None
8. **IMPOUND**: No
9. **THE COMPETITION**: This event can be run as a sit-down test or in a station format. Teams will demonstrate knowledge in any or all of the following topics:
 - a. How the Sun drives the water cycle (processes of evaporation, condensation, precipitation, and run-off).
 - b. Weather instruments (thermometer, barometer, rain gauge, hygrometer, sling psychrometer, wind vane, anemometer, weather balloon, radar, satellite).
 - c. Types of clouds and their relationships to weather conditions.
 - d. Using weather maps to identify weather conditions.
 - e. The following types of severe storms: blizzard, derecho, dust devil, flood, haboob, hail, hurricane, severe winter weather (snow, sleet, freezing rain), thunderstorm, tornado, and water spout.
 - f. Severe weather safety.
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 at www.sciencenc.com for instructions, videos and more.