2026-2027 Division A
Virginia Science Olympiad - Rules Manual

Exploring the World of Science

Tournament Dates

March 6 – C.G. Woodson High School

April 3 – Lake Braddock Secondary School

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Welcome

Welcome to the 2026-27 Science Olympiad season of Division A. Division A is the elementary school division for 3rd - 5th graders. Information for older students can be found on the Virginia Science Olympiad website.

This Rules Manual will help you prepare to compete in our Virginia tournaments this spring. To compete, students must join a team sponsored by their school. Each team consists of up to 15 students who have collectively prepared to compete in roughly 22 events as pairs or trios. Over the course of a season, each team member might specialize in two to four events. The events are rotated each year but fall roughly into the categories of life science, earth science, chemistry and physical science, build events, and nature of science events. All the students on the team will have events throughout the day, and their partners may change based on the event.

To see detailed information on starting a team and the expectations for competing, please review the 2026-27 Division Handbook. The handbook is an important resource containing schedules, registration steps and practice tips. While everyone is welcome to review the 2026-27 Division Handbook, coaches must read through it and will be asked if they have done so as part of the registration process.

Allowed Calculator

This is the acceptable calculators for all Division A events.	
Class I - Stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators. These are the most basic types of calculators. They are limited to the four basic mathematical functions and square roots. They are often cheap, costing as low as a dollar online.	

Safety Glasses

Indirect Vent Goggles or Safety glasses are a mandatory safety requirement for some events. It is important to choose the type of protection specific to the task. Competitors are responsible for providing their own protective eyewear. Teams will not be allowed to compete without adequate eye protection.

Category C: Indirect Vent Goggles	Category B: Safety glasses
	

Compliant Eyewear Categories:
CATEGORY B

- Description: Impact protection. They provide protection from a high inertia particle hazard (high mass or velocity)
- Corresponding ANSI designation/required marking: Z87+.
- Category B eyewear can look either like goggles or safety glasses, but must have the Z87+ marking embossed on them.

CATEGORY C

- Description: Indirect vent chemical/splash protection goggles. These seal tightly to the face completely around the eyes and have indirect vents constructed so that liquids do not have a direct path into the eye (or no vents at all). If you can see through the vent holes from one side to the other, they are NOT indirect vents
- Corresponding ANSI designation/required marking: Z87 (followed by D3 is the most modern designation but, it is not a requirement)

Examples of Non-Compliant Eyewear:

- Face shields/visors are secondary protective devices and are not approved.
- Prescription Glasses containing safety glass should not be confused with safety spectacles. "Safety glass" indicates the glass is made to minimize shattering when it breaks. Unless these glasses bear the Z87+ mark they are not approved for use.

Notes:
1. A goggle that bears the Z87+ mark and is an indirect vent chemical/splash protection goggle will qualify for both Category B & C
2. VisorGogs do not seal completely to the face, but are acceptable as Type C goggles

3rd Grade Balloon Racer

(Coach Scheduled Event - 45 Minutes)

Description: Teams will design, build, and race an air-powered balloon device to travel a distance along a fishing line track in the shortest amount of time. They will answer questions on Newton's Laws of Motion and air pressure.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring: ● **Safety glasses labeled ANSI Z87+ (impact rated)** ● **All competitors must wear their eye protection during the entire event.** ● **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** ● **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	Impact Safety Glasses Required  **Eyeglasses are not safety rated!**

Teams must also bring:

- Writing Utensils
- One pair of scissors

Materials Provided at the Event:

- 3- 30 cm (12 in) Balloons
- 1 - Paper Smoothie straw - 10 mm (0.4 in) diameter, 23 cm (9 in) length (wide opening)
- 2 - Paper straws - 6 mm (0.24 in) diameter, 20 cm (7.75 in) length
- 3 - #16 Rubber band
- 1 - 22 cm by 30 cm (8 ½ in x 11 in) 60 to 90 pound cardstock
- 50 cm (20inches) of 2.54 cm (1 in) masking tape
- Competition Track and a similar Practice Track
- Balloon inflater

The Competition:

The Written Assessment: The team members will take a written assessment on their understanding of Newton's Laws of Motion and air pressure. The test will take place simultaneously during the construction of the team racer.

- *As a part of the written test the team will estimate the time needed for their racer to travel the competition day distance.*

Construction Phase (30 minutes):

- Teams may cut their materials to any size they deem appropriate,
    - Teams may use as much or as little of their materials to build their racer, except that the

team's design must have one straw to be taped to the outside of their balloon to use for the Competition Track line to pass through. That straw may be cut, but must still accommodate the fishing line track for the vehicle to run on the track.

    - Teams may request one additional balloon without penalty if they break one, but requests for any additional materials beyond that places the team in Tier 3. This means that the team may still participate but will be placed below all teams that do not violate this rule.
- Teams may have 1 untimed practice run on a practice track that is roughly the same length as the competition track to test their racer within the 30 minutes build time with permission of the Event Supervisor
    - Releasing a racer down either the practice track or the competition track without permission of the Event Supervisor during both the testing and scoring phases of the competition will result in a team being placed in Tier 3.
    - Practice runs will not occur after the 30-minute build time

The Competition Track:

- The Competition Track will be a fishing line along which the balloon racer travels. It will have one end of the fishing line attached permanently on one side of the room. The other end will be clipped to something at the same height as the permanent end. The track will be high enough off the floor so that the racer will not touch the ground.
- The length of the competition Track will be released the day of the competition and is subject to space limitations. It will be no more than 6 meters and no less than 3 meters.

Official Testing:

- The team will feed the non-permanent end of the competition track through one straw attached to their racer to prepare it for the run. The Event Supervisor will then clip the non-permanent end so that the track is parallel to the ground.
- Each team will have one officially scored run
- The team must state that they are ready to release the racer and must wait for the Event Supervisor to acknowledge they are ready to time the run.
- After the Event Supervisor's acknowledgement, a team member will make a loud announcement of, "3, 2, 1, LAUNCH!" and release the racer.
- Team members may not push their racer during the release. Teams that push their racer at any time will be placed in Tier 3, which means that they will be scored behind all other teams.
- The Event Supervisor will record the time for the racer from the start until the finish point to the precision of their timing device.
- If the racer does not reach the finish line, the Event Supervisor will record how close to the finish line the front of the racer is. That racer will be placed in Tier 2 and the recorded distance will substitute for the Time Score.

Scoring:

Final Score (FS) = Assessment Score + Time Score, max 100 points

- Assessment score = (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
    - Team Assessment Score (TAS) = team's score on the assessment
    - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Time Score = (CT ÷ TT) x 50; rounded to the 100th place value; maximum 50 points
    - Competition Time (CT) = the lowest Time for all teams
    - Team Time (TT) = the team's Time
- Tiers
    - Tier 1 - the racer is not in Tier 2 or Tier 3. Tier 1 teams score before Tier 2 or Tier 3 no matter their score.

    - Tier 2 - the team's racer does not make it to the finish line
    - Tier 3 - the team requests additional build materials beyond a second balloon, team takes a disallowed practice run, or team pushes their racer during their official test.

Scoring Example

- Competition Assessment Score (CAS) = 15. The team scores 9 (TAS) on the assessment.
  Assessment Score for the team = (9 ÷ 15) x 50 = 30 points
- Competition Time (CT) = 1.45 seconds. The team's time (TT) is 3.56 seconds.
  Time Score for the team for the team = (1.45 ÷ 3.56) x 50 = 20.36 points
- Final Score (FS) = 30 + 20.36 = 50.36 points

Tiebreakers:

- 1st - The team with the closest estimate to their travel time
- 2nd - The better score on the written test
- 3rd - Select questions on the test

Resources:

- NASA - What Is Aerodynamics?
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

3rd Grade Biomes

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of ecological principles, ecosystems, species interactions, and major terrestrial and aquatic biomes.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring:

- Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

(Optional) Teams may bring:

- Four-function calculator

Safety Requirements: None

The Competition: This event may be administered as a written test or as a series of stations which can include diagrams, maps, specimens, photographs, data analysis, and problems for students to solve.

Content topics will include but are not limited to:

1. Ecology Fundamentals

- Define and apply the concepts of organism, population, community, ecosystem, biome, habitat, and niche.
- Distinguish between biotic and abiotic factors.
- Explain the roles of producers, consumers, and decomposers and how energy moves through ecosystems using food chains, food webs, and energy pyramids.
- Describe common species interactions including predation, competition, mutualism, commensalism, and parasitism.

2. Biomes and Adaptations

- Identify major terrestrial biomes including tundra, taiga, temperate deciduous forest, temperate grassland, desert, tropical rainforest, and savanna, as well as major freshwater and marine ecosystems.
- Describe the climate, vegetation, characteristic organisms, and geographic distribution of each biome.
- Explain how structural, behavioral, and physiological adaptations help organisms survive in specific environments.
- Compare and contrast the characteristics of different biomes and ecosystems.

3. Biodiversity and Human Impact

- Explain the importance of biodiversity and ecosystem health.
- Describe the effects of habitat loss, pollution, invasive species, and climate change on ecosystems and biomes.

- Identify conservation practices that help protect ecosystems and biodiversity.

4. Data Analysis and Applications

- Interpret diagrams, maps, charts, graphs, tables, and models related to ecology and biomes.
- Apply ecological principles and biome characteristics to analyze data and solve problems.

Examples:

- Given a food web, identify producers, consumers, predators, prey, and decomposers.
- Interpret an energy pyramid to determine which trophic level contains the most energy.
- Compare two biomes using climate graphs, maps, or data tables.
- Use a biome map to identify the most likely biome for a given location.
- Analyze population graphs to identify trends, limiting factors, or carrying capacity.
- Interpret predator-prey graphs to determine how changes in one population affect another.
- Use ecological succession diagrams to identify the stage of ecosystem development.
- Interpret species distribution maps to predict the effects of habitat loss or fragmentation.
- Analyze tables of temperature, precipitation, and vegetation to identify a biome.
- Predict how changes to one component of an ecosystem (e.g., invasive species, drought, wildfire, pollution) affect the rest of the ecosystem.
- Apply concepts of biodiversity, food webs, and ecological interactions to solve ecosystem-based scenarios.

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- Biomes
- Ecology
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

3rd Grade Human Body

(Scheduled Event - 30 minutes)

Description: Participants will be assessed on their understanding of the structure, function, and organization of major human body systems and the organs that comprise them.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring:

- Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

(Optional) Teams may bring:

- Four-function calculator

Safety Requirements:

- None

The Competition: This event may be administered as a written test or as a series of stations which may include diagrams, models, specimens, medical images, data analysis, and problems for students to solve. Content topics will include but are not limited to:

1. Human Body Systems

- Describe the levels of organization within the human body, including cells, tissues, organs, and organ systems.
- Explain how organ systems work together to maintain homeostasis.
- For each body system, identify the major organs and structures, their locations, and their functions. Systems studied will include: Skeletal, Muscular, Digestive, Respiratory, Circulatory, Excretory, Nervous, Sensory, and Endocrine

2. Data Analysis and Applications

- Interpret diagrams, models, charts, tables, medical images, and other representations of human body systems.
- Apply knowledge of anatomy and physiology to identify organs, determine functions, and solve scenario-based problems.

  Examples:

  - Given a diagram of the human body, identify the major organs in the digestive, respiratory, circulatory, skeletal, muscular, and nervous systems.
  - Match organs to their primary functions (e.g., heart pumps blood, lungs exchange oxygen and carbon dioxide).
  - Interpret simple diagrams showing how body systems work together (e.g., lungs and heart, muscles and bones).
  - Identify bones, joints, or major muscle groups from labeled diagrams or models.

- Use a simple food digestion diagram to trace the path food takes through the digestive system.
- Interpret a heart rate, breathing rate, or body temperature chart before and after exercise.
- Compare healthy and unhealthy X-rays or other simplified medical images (e.g., broken vs. unbroken bone, healthy vs. cavity-affected tooth).
- Determine which body system is responsible for a specific function or action.
- Apply knowledge of body systems to solve everyday scenarios (e.g., "Which system helps you catch a ball?" or "Which organ works harder during exercise?").
- Analyze simple tables or diagrams to determine how exercise, nutrition, hydration, or rest affects the body.

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- Human Body
- Biology for Kids
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

3rd Grade Picture This

(Scheduled Event - 30 Minutes)

Description: Team members will take turns drawing scientific terms while their teammates attempt to correctly identify each term based on visual representations. Terms will be drawn from the provided science term list with content across physical, life, earth, and space science.

Participants per assigned Team Number: 3

- If your school has 1 team you will send 3 students
- If your school has 2 teams you will send 3 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 3 students per team number; team numbers may not intermix

Teams must bring:

Two black dry-erase markers

Materials Provided at Event:

a. Dry-erase boards (approx. 22 cm × 27 cm)
b. A event supervisor term list (same order for all teams)

Safety Requirements:

- None

The Competition:

Each team will attempt to correctly identify as many terms as possible within 5 minutes. Teams will rotate drawing responsibilities so that each member participates as the sketcher.

- Only one team member draws at a time; all others guess.
- The sketcher may not speak, except to pass a term.
- Teams may pass on a term but may not return to it.
- Once a term is passed, it is scored as incorrect.
- The Event Supervisor will provide the same ordered list of terms to all teams.
- Timing begins when the first term is revealed.
- No letters, numbers, or written words are allowed in drawings.
- Approved visual symbols include arrows, plus (+), minus (–), and blank lines for word length.
- The sketcher may not use gestures beyond simple head nods or supervisor-approved signals.
- Correct identification is confirmed only by the Event Supervisor.
- Plurals and singulars are interchangeable forms of the same term.

Scoring:

a. One point per correctly identified term.
b. Highest total score wins.

Tiebreakers:

i. Fewest passed terms
ii. Fastest completion time (if applicable)
iii. Longest consecutive streak of correct answers
iv. First unmatched term correctly identified by a team

Life Science

1. cell
2. nucleus
3. mitochondria
4. ribosome
5. chloroplast
6. DNA
7. gene
8. chromosome
9. enzyme
10. diffusion
11. osmosis
12. mitosis
13. meiosis
14. bacteria
15. virus
16. fungi
17. plant cell
18. animal cell
19. ecosystem
20. food chain
21. food web
22. photosynthesis
23. cellular respiration
24. producer
25. consumer
26. predator
27. prey
28. adaptation
29. evolution
30. habitat

Human Body / Systems

31. heart
32. brain
33. lungs
34. stomach
35. liver
36. kidney
37. skeleton
38. muscle
39. neuron
40. reflex
41. circulation
42. digestion
43. respiration
44. nervous system
45. endocrine system
46. homeostasis
47. stimulus
48. response
49. immunity
50. infection

Earth Science

51. rock cycle
52. erosion
53. weathering
54. deposition
55. earthquake
56. volcano
57. magma
58. lava
59. tectonic plate
60. fault
61. tsunami
62. hurricane
63. tornado
64. glacier
65. sediment
66. groundwater
67. aquifer
68. atmosphere
69. climate
70. water cycle
71. condensation
72. evaporation
73. precipitation
74. greenhouse effect
75. climate change

Physics / Energy Concepts

76. force
77. motion
78. velocity
79. acceleration
80. gravity
81. friction
82. inertia
83. mass
84. weight
85. energy
86. kinetic energy
87. potential energy
88. heat transfer
89. conduction
90. convection
91. radiation
92. electricity
93. circuit
94. magnetism
95. Newton’s first law
96. Newton’s second law
97. Newton’s third law
98. work
99. power
100. conservation of energy

3rd Grade Truss Bridge

(Coach Scheduled Event - 45 Minutes)

Description: Teams will design and construct a truss bridge that spans a 30.0 cm gap between two supports. The bridge will be tested by supporting a 300 g mass and, if successful, a 500 g mass for 30 seconds each. Teams will also complete a written assessment covering bridge types, structural design, and forces acting within bridges.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring: • **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	Impact Safety Glasses Required  **Eyeglasses are not safety rated!**

Teams must also bring:

- Pencil, pen, or marker
- Ruler or straightedge
- A pair of scissors per team member

Materials Provided at Event:

- 30 paper drinking straws approximately 20 cm (8 in) each
- 1 meter (36 in) of 2.54 cm (1 in.) tape
- Two support blocks cut from commercial 2 x 4 lumber, of approximately 30 cm (11.8 in) long
- One wooden loading block approximately 5 cm × 5 cm × 2 cm (2 in x 2 in x 3/4 in)
- One 300 g (11 oz) mass
- One 500 g (18 oz) mass

The Competition:

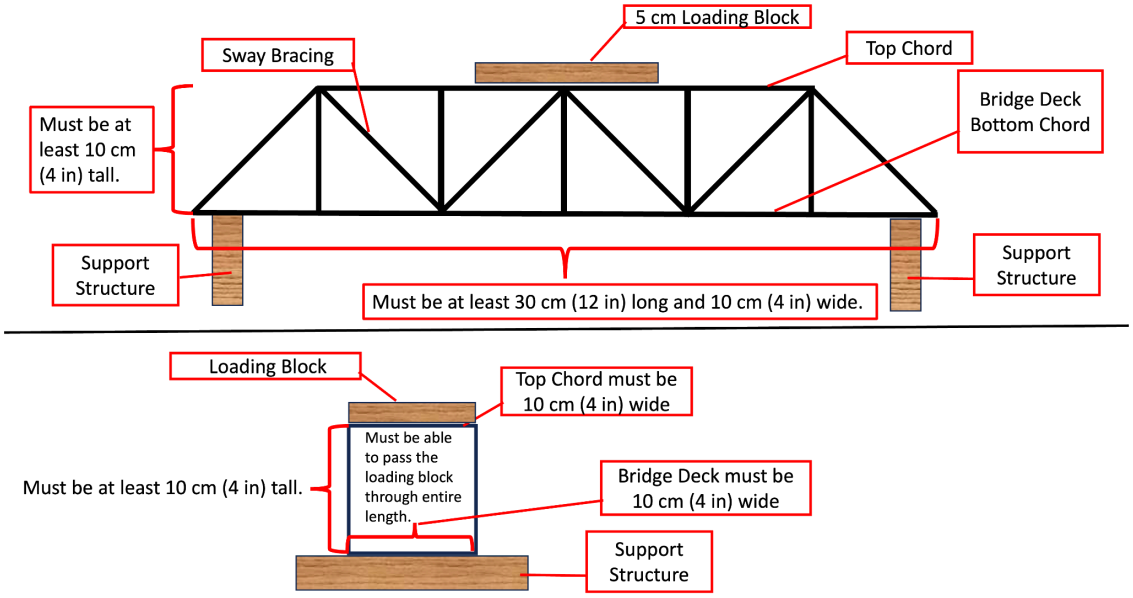
Construction Phase (30 minutes):

The bridge must:

- Span a 30.0 cm gap between supports.

- Be constructed entirely from the provided straws and tape. Teams may cut, bend, or crimp the straws and may slide them inside one another. Teams may not bring any preconstructed components or use materials not provided by the Event Supervisor.
- Have a minimum width of 10.0 cm at its midpoint, measured from outside edge to outside edge.
- Be at least 10 cm tall at its midpoint. Height is measured from the top surface of the supports to the top of the top chord.
- Allow the square face of the loading block to pass completely through the bridge along its entire length without obstruction and without turning or twisting the loading block.
- Support the loading block applied at the center apex of the bridge.

Competition Diagram (picture not drawn to scale):



The Written Assessment: Simultaneously with the device testing time, the team will take a written assessment. Teams will be called up from their written assessment to test their device and then will return to their written assessment while other teams test their device. The assessment topics may include:

- Types of bridges
- Bridge design principles
- Structural forces (tension, compression, shear, torsion)
- Load distribution
- Failure modes
- Engineering applications of trusses

Device Testing Setup:

- The Event Supervisor (ES) will place the support blocks on a level surface with the inner edges 30.0 cm (12 in) apart.
- Teams will place their bridge on the supports. No sticky surface of the tape may contact the tops or sides of the supports. If the team's bridge does not span the distance, the supports will be moved closer together forr testing and the team will receive a percentage penalty (see Scoring).

Device Testing Measurements

- Before testing, the team will demonstrate that the loading block passes completely through the bridge.
- Before testing, the ES will record:
    - Whether the bridge spans the gap.
    - Whether the width requirement of 10 cm is met.
    - Whether the height requirement of 10 cm is met.
    - The height of the bridge at its center to the nearest 0.1 centimeter.
    - The number of unused, complete straws.

Load Testing

- The team will place the loading block at the center of the bridge.
- Timing begins once the 300 g mass is placed on the loading block and is fully released from the team's hand.
- Once testing begins, competitors may not touch the bridge. A bridge successfully supports a load if it remains intact and all parts of the bridge remain above the top level of the supports for 30 seconds.
- If the bridge successfully supports the 300 g mass for 30 seconds, the procedure is repeated using the 500 g mass.
- Testing ends when:
    - Any part of the bridge falls below the top level of the testing surface
    - The load falls off the loading block
    - The bridge is touched by competitors after testing begins.
    - Thirty seconds have elapsed.
    - Students remove their protective eyewear.

Scoring:

Final Score (FS) = Assessment Score + Bonus x Bridge Score

- Bridge Score = (THS ÷ CHS) x 60, maximum is 60 pts
    - THS (Team Height Score) = Penalties x TH
        - TH (Team Height): Height of the team's bridge at the center
    - CHS (Competition Height): Maximum THS over all the teams
- Assessment Score = (TAS ÷ CAS) x 40, maximum is 40 pts
    - TAS (Team Assessment Score): Team written assessment score
    - CAS (Competition Assessment Score): Highest written assessment score across teams
- Penalties -
    - .70 multiplier (30% penalty)
        - Bridge does not hold the 300g weight for 30 seconds
    - .20 multiplier (80% penalty)
        - Bridge width is less than 10cm at the midpoint
        - Loading block does not pass through the bridge
        - Tape is used to stick the bridge to the support structure
        - The height of the bridge is less than 10cm at the midpoint.
    - Both penalties can be applied.
- Bonus
    - If the bridge can hold the 500 g mass for 30 seconds, the Bridge will receive a 20% bonus.

Scoring Example

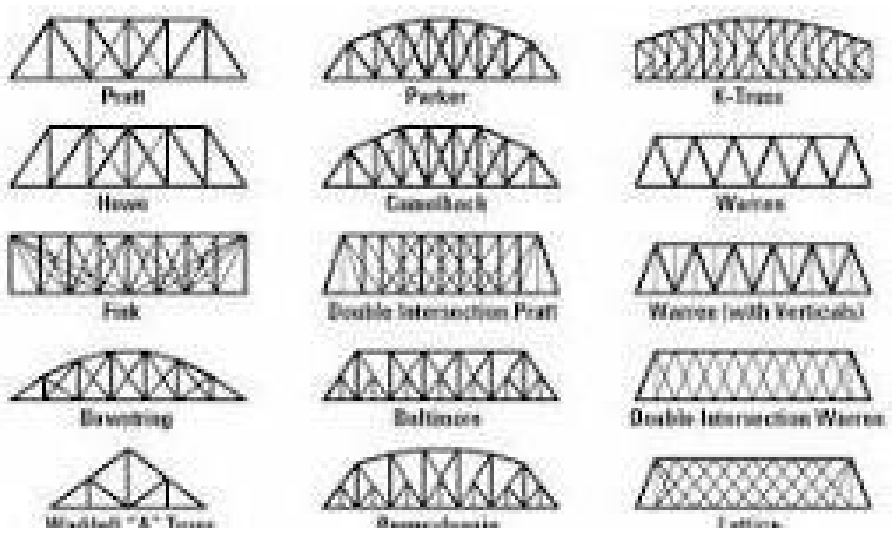
- Competition Assessment Score (CAS) = 9.
- The team scores 6 on the assessment (TAS).
    - Assessment Score for the team= (6 ÷ 9) x 40 = 26.67 points
- Team's height = 12 cm, there are no penalties. The bridge also held the 500 g weight.
- The CHS = 15 cm
- Bridge Score = (12 ÷ 15) x 60 = 48 points
- Final Score (FS) = 26.67 + 1.2 x 48 = 84.27

Tiebreakers:

- Number of unused straws
- Select test questions

Resources:

- https://www.youtube.com/watch?v=oVOnRPefcno
- https://thestemlaboratory.com/straw-bridges/
- https://www.stem-inventions.com/truss-bridge (This site uses materials that are different from the one used for this event.)
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here
- Pictures of Truss Bridges:



Anatomy

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of the anatomy and physiology of the human digestive system.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring: Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Optional - Teams may bring: Four function calculator

Safety Requirements: None

The Competition: This event may be administered as a written test or as a series of stations which can include diagrams, models, specimens, data analysis, experiments, and problems for students to solve. Content topics will include but are not limited to:

1. Organization and Anatomy of the Digestive System

- Functions of the digestive system.
- Distinguish between digestive tract organs and accessory digestive organs.
- Identify the major digestive organs and describe their structure and function.

2. Digestive Processes

- Trace the pathway of food through the digestive system.
- Compare and contrast mechanical and chemical digestion.
- Describe the roles of saliva, stomach acid, bile, and digestive enzymes.
- Explain how carbohydrates, proteins, and fats are broken down into absorbable molecules.

3. Absorption, Transport, and Regulation

- Describe how nutrients and water are absorbed and transported throughout the body.
- Compare the roles of the small intestine and large intestine in absorption.
- Explain how digestive structures support absorption.
- Describe how the nervous system and digestive organs regulate and coordinate digestion, including hunger and satiety signals.

4. Nutrition and Digestive Health

- Identify the major nutrient groups: carbohydrates, proteins, fats, vitamins, minerals, and water.
- Describe the primary functions of each nutrient group.
- Explain the characteristics of a balanced diet and its relationship to digestive health.

5. Digestive System Disorders

- Describe the causes, symptoms, prevention, and basic treatment of acid reflux (GERD), lactose intolerance, constipation, diarrhea, peptic ulcers, and appendicitis.

6. Data Analysis and Applications

- Interpret diagrams, charts, tables, models, and experimental data related to digestion and digestive health.
- Apply knowledge of digestive anatomy and physiology to solve problems and answer scenario-based questions.

Examples:

- Identify major digestive organs from diagrams or models
- Distinguish between **digestive tract organs** and **accessory organs** using diagrams or tables.
- Trace the pathway of food through the digestive system from ingestion to elimination.
- Interpret diagrams showing how food moves through the digestive tract.
- Identify where mechanical digestion and chemical digestion occur.
- Compare the roles of - chewing, stomach churning, enzymes, acids, bile
- Analyze models showing how carbohydrates, proteins, and fats are broken down into smaller molecules.
- Match digestive enzymes and substances to their functions:
- Interpret charts or tables showing nutrient breakdown and absorption.
- Compare the functions of the small intestine and large intestine using diagrams or data.
- Analyze diagrams of intestinal structures (e.g., villi) to explain how they increase nutrient absorption.
- Interpret experimental data related to digestion, such as:
    - effect of temperature on enzyme activity
    - effect of pH on digestion
    - rate of food breakdown
    - Analyze nutrition labels or food tables to identify:carbohydrates, proteins, fats, vitamins, minerals, water
    - Compare diets and determine which provides better nutritional balance.
    - Interpret charts showing relationships between diet, hydration, and digestive health.
- Analyze case studies involving digestive disorders, including:acid reflux (GERD), lactose intolerance, constipation, diarrhea, peptic ulcers, appendicitis
    - Use symptoms and scenario information to identify possible digestive problems.
    - Recommend basic prevention strategies related to digestive health, such as: fiber intake. Hydration, balanced nutrition, healthy eating habits
- Apply digestive system knowledge to real-world scenarios (e.g., "Why does a person with lactose intolerance experience symptoms after consuming milk?").

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- The Human Body Book by Steve Parker
- Biology for Kids
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Astronaut Lander

(Coach Scheduled Event - 45 minutes)

Description: Teams will design and construct a landing device that safely protects a simulated astronaut during a landing from a designated height. Before construction, teams will participate in a mock purchasing process, being scored on their use of a limited budget to select the materials used. Teams will also complete a written assessment covering the forces, energy transformations, and engineering principles involved in protecting astronauts during reentry and landing.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring: • **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	Impact Safety Glasses Required  **Eyeglasses are not safety rated!**

Teams must bring:

- Team's "Astronaut Lander Materials Shopping List" with the cost of materials calculated (The Shopping List is a separate page printed in these rules.)
- Writing utensils
- Scissors

Teams may bring:

- 1 four-function calculator

Materials Provided at Event:

All teams will "purchase" materials from the "Store" in the Event Room to build their lander - teams must bring The Shopping List filled out
"Cost" at the "Store" is listed in parenthesis before the item.

- (Free, must be used) 1 - piece of cardboard, approximately 10 x 13 cm (4 in x 5 in)
- (Free, must be used) 1 - 147 ml (5 oz paper cup) the capsule
- (Free, must be used) 1- 2.54 cm diameter (1 in) Bouncy Ball
- ($5 each) 3 - index cards 8 x 13 cm (3 in x 5 in)
- ($0.50 per cm) Up to 100 cm (39 in) of string
- ($5 each) 3 - rubber bands, choose from length sizes #64, #33, #19, sizes may be mixed
- ($5 each) 4 - 20 cm (8 in) paper straws
- ($0.50 per cm) Up to 100 cm (39 in) of 2.54 cm (1 in) masking tape
- ($10 each) 10 - mini marshmallows 6 cm diameter x 9 cm height (0.23 in x 0.35 in)

- Student choice of coffee filters up to 4:
    - ($5 each) Size #1 1 cup
    - ($5 each) Size #2 2-6 cups
    - ($10 each) Size #4 8-12 cups
    - ($15 each) Size #6 Very large capacity

THE COMPETITION

The Written Assessment: The team will answer questions on a written assessment about the forces, energy transformations, and engineering principles involved in protecting astronauts during landing. The test will take place simultaneously during the construction of the team's lander.

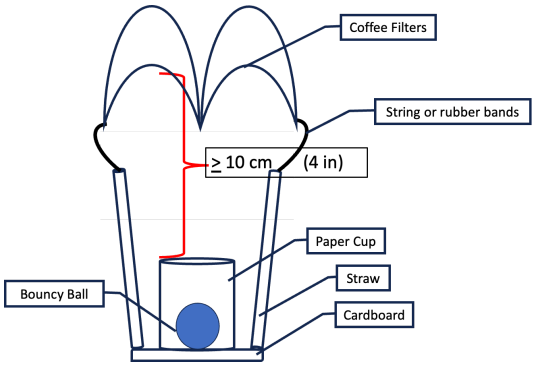
During the written test, the team will give an estimate of the flight time of their lander.

Construction Phase (25 min):

- The Event Supervisor will announce the distance for the drop to the ground floor at the start of the construction phase.
- Teams will present their Shopping List to the Event Supervisor. If the list is not present or not filled out in its entirety, the team will be allowed to create a list, but will receive a penalty to their score. The team will not receive any extra build time or ES assistance if the list has to be modified or created.
- Upon receiving and evaluating the list, the Event Supervisor will provide the "purchased" materials.
- The team will build an astronaut lander using the "purchased" materials. They do not have to use all of the materials, but they must use the paper cup, cardboard piece, and bouncy ball.
- The team may cut the materials, **except the bouncy ball, and the paper cup,** to any size needed or leave them whole
- The team may not create a method or use tape to keep the bouncy ball inside the cup and below the cup lip.
- The team may not build any part of their device within 10 cm directly over the top of the cup lip (see the diagram in the Possible Resources section).

Competition Diagram:

- This diagram is for rules understanding only. It is not meant to be a blueprint for a team design!



Launch Phase:

- The team will place the bouncy ball in the provided cup. The bouncy ball may not be wedged or taped into the provided cup
- The team will hold their lander so that the bottom of the lander is parallel to the bottom of the launch zone and announce to the Event Supervisor they are ready to drop.
- After receiving a reply from the supervisor, the team will then use a 4-point count down, such as "3, 2, 1, drop", to start the lander falling
    - The team may not move the lander upwards or downwards while they are letting go.
- The Event Supervisor will measure and record the time for the lander to reach the ground.
- Time will continue if the lander bounces off an object but will stop when the lander gets stuck or comes to a complete stop.
- Time will be recorded in seconds to the nearest 1/100.
- The launch is considered "successful" if the bouncy ball astronaut does not exit the capsule when landing.

SCORING:

Final Score (FS) = Assessment Score + (Time Score + Shop Score) x Penalties, max 100 pts

- Assessment Score = (TAS ÷ CAS) x 40; rounded to the 100th place value; maximum 50 points
    - Team Assessment Score (TAS) = team's score on the assessment
    - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Time Score = (TT ÷ CT) x 30; rounded to the 100th place value; maximum 50 points
    - Competition Time (CT) = the longest drop time for all teams
    - Team Time (TT) = the team's drop time
- Shop Score = (CC ÷ TC) x 30; rounded to the 100th place value; maximum 50 points
    - Competition Cost (CC) = the lowest spent at the shop over all teams
    - Team Cost (TC) = the team's amount spent at the shop on materials
- Penalties:
    - Construction Penalty (0.8 multiplier) : A team lander that does not meet the construction guidelines or their astronaut falls out of the cup will receive a 20% penalty to their time+shop score.
    - Missing Shopping List Penalty (0.7 multiplier): A team who does not bring a completed shopping list will receive a 30% penalty to their time+shop score.

- Example
    - Competition Assessment (CAS) = 15. The team scores (TAS) 9 on the assessment. Assessment Score for the team= (9 ÷ 15) x 40 = 24 points

    - Competition Time (CT) = 3.56 seconds. The team's flight time (TT) is 1.45. Time Score for the team = (1.45 ÷ 3.56) x 30 = 12.22 points

    - Competition Cost (CC) = $120, The team's cost (TC) is $160.
    - Shop Score for the team = (120 ÷ 160) x 30 = 22.50 points

    - Penalties - the team had an incomplete shopping list = 0.7 multiplier
    - Final Score (FS) = 24 + .7 x (12.22 + 22.50) = 48.30 points

Tiebreakers:

- 1st - The smallest difference between the actual and estimated flight times
- 2nd - Correct answers on selected written assessment questions

Resources:

- Make an Astronaut Lander – Engineering Project | NASA JPL Education
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

“Purchasing” of Materials

Each team must bring to the competition their completed shopping list using the template listed below. For their shopping, each team may list any items from the list up to a total cost $200.

Team # _____ School Name _____ Team Name _____

Astronaut Lander Materials List

Materials	Part “Price”	Max Allowed	Number Needed	Purchase Cost
Cardboard	Free	1	1	0.00
Capsule	Free	1	1	0.00
Bouncy Ball	Free	1	1	0.00
Index cards	$5 each	3		
String	$0.50 per cm	100 cm		
Rubber bands	$5 each	3		
Paper straws	$5 each	4		
Masking tape	$0.50 per cm	100 cm		
Mini marshmallow	$10 each	10		
Student choice of coffee filters - max 4 coffee filters total				
Size #1 1 cup	$5 each	4 filters max over all sizes		
Size #2 2-6 cups	$5 each	4 filters max over all sizes		
Size #4 8-12 cups	$10 each	4 filters max over all sizes		
Size #6 Very large capacity	$15 each	4 filters max over all sizes		
TOTAL COST				

Astronomy

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of the formation, classification, evolution, and life cycles of stars.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring: Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Optional - teams may bring:

- Four-function calculator

The Competition: This event may be administered as a written test or as a series of stations which may include diagrams, photographs, spectra, H-R diagrams, data analysis, models, and problems for students to solve.

Content topics will include but are not limited to:

1. Star Formation and Properties

- Describe how stars form from nebulae through protostar and main-sequence stages.
- Explain the roles of gravity, pressure, and nuclear fusion in star formation.
- Compare stars based on mass, size, temperature, luminosity, and color.

2. Classification and Stellar Evolution

- Classify stars using the Hertzsprung-Russell (H-R) Diagram and basic spectral classes.
- Identify and compare main-sequence stars, giants, supergiants, white dwarfs, neutron stars, and black holes.
- Describe the evolutionary pathways of low-mass stars (red giant → planetary nebula → white dwarf) and high-mass stars (red supergiant → supernova → neutron star or black hole).
- Explain how stellar mass, color, and temperature influence a star's classification, lifespan, and evolution.

3. The Sun

- Identify the major layers of the Sun and their functions.
- Explain how the Sun produces energy.
- Describe the Sun's current stage in the stellar life cycle.

. 4. Representative Objects

Students should be familiar with the significance and classification of:

- The Sun
- Orion Nebula
- Proxima Centauri
- Sirius
- Betelgeuse
- Crab Nebula

5. Data Analysis and Applications

- Interpret simplified diagrams, spectra, H-R diagrams, graphs, tables, and astronomical images.
- Apply concepts of star formation, classification, and the basic stages of stellar evolution to analyze data and solve problems.

  Examples:
  - Given an H-R diagram, identify which star is hottest.
  - Compare the brightness of two stars.
  - Determine which star is likely to become a red giant.
  - Match star colors with approximate temperatures.
  - Identify the stage of a star's life from a diagram.
  - Interpret a simple spectrum to determine whether two stars contain the same element.
  - Use a graph of stellar brightness over time to identify a variable star.

Scoring:

- Points will be awarded for each correct response

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- Stars
- Stellar Evolution
- Life of a Star
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Bungee Drop

(Coach Scheduled Event - 45 Minutes)

Description: Teams will design and construct a bungee cord system to drop a weight from a designated height. Teams will also answer questions on a written assessment on the principles of the law of conservation of energy, elastic potential energy, gravitational potential energy, and kinetic energy.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:	Impact Safety Glasses Required
• **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	 **Eyeglasses are not safety rated!**

Teams may also bring:

- Writing utensils (must bring for the written assessment)
- Ruler or meter stick
- Scissors

Materials Provided at the Event:

- An assortment of rubber bands, sizes #64, #33, #19, and #117B.
- 50 cm (19.5 in) of 2.54 cm (1 in) masking tape

Bottle Weight provided by the ES for the drops (pictured):

- One 16.9 oz water bottle attached to a carabiner
- Solid material, such as BBs or sand, will be put in the water bottle so that the entire bottle assembly (including the carabiner) will mass 100 g.

THE COMPETITION

Written Assessment: The team will answer assessment questions simultaneously with the 25-minute building phase on the principles of the law of conservation of energy, elastic potential energy, gravitational potential energy, and kinetic energy.

Construction Phase (25 min):

- The Event Supervisor will announce the designated height, the Target Drop Distance (TDD), to the artificial horizon at the start of the construction phase. The Target Drop Distance is measured from the bottom of the Bottle Weight when the weight is hung by the carabiner from the drop apparatus. The Target Drop Distance can be from 200 cm to 500 cm.

- At the bottom of the drop, a paper chart will have a horizontal line that is the artificial horizon. This line is the zero point, with additional horizontal lines above it and below it marked from -100 cm (below) to +100 cm (above).
- The team will choose and connect rubber bands to create a bungee cord. They may cut the rubber bands to any size or leave them whole and may tie or tape them together in any manner they choose.

Bungee Testing:

- Each team will have 2 drops for this competition.
- For each drop, the partners will:
    - Clip the water bottle weight to a rubber band on their bungee. The team may attach the water bottle at the very end of the bungee or at a rubber band higher up.
    - Hang the other end of their bungee to the Retaining Hook on the Bungee Drop Platform, making sure that the rest of the rubber bands on their bungee are hanging loose over the front of the platform.
    - Hang the water bottle's carabiner from the drop release mechanism.
    - They will announce to the Event Supervisor they are ready to drop and wait for a reply from the supervisor.
- The Event Supervisor will set their video recording device in such a way as to show the entire Artificial Horizon Chart and record the fall in slow motion.
    - Once the supervisor has the camera ready, the team will trigger the release mechanism to drop the water bottle.
    - The recording must have visible in the background a horizon chart marked in 1 centimeter increments as the distance gauge, visible in the background, +100 cm to -100 cm.
- The Event Supervisor will review the recording and record the distance from the horizon, plus or minute, to the nearest centimeter mark before the team makes the second drop. The distance from the horizon will be measured to the bottom of the water bottle.
- The team may use the information from the first drop to alter where on the bungee they hang the water bottle for the second drop. They may not alter the bungee itself between drops.

SCORING: Final Score (FS) = Assessment Score + Best Drop Score, max score = 100 points

- Assessment score = (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
    - Team Assessment Score (TAS) = team's score on the assessment
    - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Drop Score = (CDS ÷ TDS) x 50; rounded to the 100th place value; maximum 50 points
    - Competition Drop Score (CDS) = the best Team Drop score over all drops
    - Team Drop Score (TDS) = Difference x Possible Penalty
        - Difference = absolute value of the distance from the 0 horizon
        - If the bottom of the bottle does not fall within 100 cm on either side of the horizon, the distance from the horizon will be recorded as 200 cm.
        - Possible Penalty: If the bottom of the bottle falls past the horizon, the Difference will be multiplied by 3.
        - If the bungee breaks or the weight falls off the bungee on the team's first drop, the team will receive a Drop Score of 0 and will not receive a second drop. If either of these issues happens on the second drop, the team will receive the score from their first drop.

Scoring Example

- Competition Assessment Score (CAS) = 9.
- The team scores 6 on the assessment (TAS).
    - Assessment Score for the team= (6 ÷ 9) x 50 = 33.33 points
- Competition Drop Score (CDS) = 5 cm
- Team's best drop distance = - 6 cm (bottle bottom passes the 0 horizon by six centimeters)

- Best Team Distance Score = absolute value(-6) x 3 = 18
    - Drop Score = (5 ÷ 18) * 50 = 13.89
- Final Score (FS) = 33.33 + 13.89 = 47.22

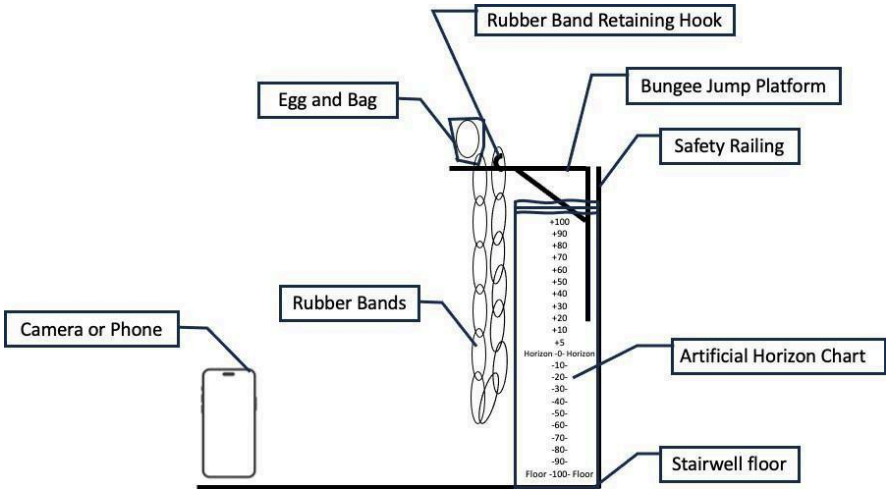
Tiebreakers

1. Written Assessment Score
2. Correct answers on selected written assessment questions

Resources

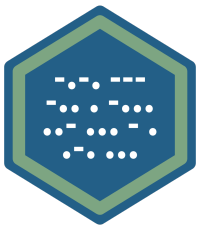
- Bungee-Jumping Egg – Flinn Scientific (.pdf download)
- Egg Bungee Teacher Notes – Science Scope, February 2005 (.pdf download)
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Competition Diagram (diagram is from previous year. A water bottle weight replaces the egg.



Codebusters

(Scheduled Event - 30 Minutes)



Description: Teams will use cryptanalysis techniques to decrypt encrypted messages using a variety of historical and modern ciphers.

Participants per assigned Team Number: 3

- If your school has 1 team you will send 3 students
- If your school has 2 teams you will send 3 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 3 students per team number; team numbers may not intermix

Teams must bring:

- Pen/Pencil

Teams may bring:

- Four-function calculator
- VASO Division A Codebuster Resources Sheet

Teams may not bring:

- Any notes or guides of any kind.

Safety Requirements:

- None

Materials Provided at the Event:

- Work space sheets and scratch paper
- VASO Division A Codebusters Resources Sheet

The Competition: This event consists of a written exam in which participants use cryptanalysis techniques to decrypt encrypted messages using one or more of the following cipher types:

(No code will have a readability higher than 9th grade. Some ciphers are more difficult and will therefore have a higher point total possible, e.g. Caesar is easier than Aristocrats, so it will have a higher possible point designation.)

The code types that may be used for this exam are:

- Aristocrats with a hint (Messages with spaces included, and with the hint; no letter can ever decrypt to itself)
- Atbash Cipher (English alphabet)
- Caesar (Shift) cipher
- PigPen/Masonic
- Polybius Square
- Running Man
- Vigenère Cipher (with provided key)

Bonus Decoding:

- Simple Cryptarithm

Scoring:

- The high score wins.
- Scores are calculated on the total number of correct ciphers solved.
- Each complete and correct cypher earns a bonus 1/10 of the total cypher characters.

Tie Breakers:

- Ties are broken by review of the worksheets showing that all characters are in the correct placement for each cipher.

Resources:

TOEBES: Science Olympiad Code Busters

Energy

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of energy forms, energy transformations, energy transfer, and major renewable and nonrenewable energy sources, including real-world energy production systems.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring: Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Optional - teams may bring:

- Four-function calculator

Safety Requirements:

- None

The Competition: This event may be administered as a written test or as a series of stations which may include diagrams, models, data analysis, case studies of energy facilities, and problems for students to solve.

Content topics will include but are not limited to:

1. Energy Concepts

- Define energy and identify common forms including kinetic, potential, thermal, chemical, electrical, and nuclear energy.
- Apply the law of conservation of energy.
- Describe energy transformations in real-world systems.

2. Energy Transfer

- Describe conduction, convection, and radiation with real-world examples.
- Explain how energy is transferred and transformed in physical systems.

3. Renewable and Nonrenewable Energy Sources

- Identify renewable sources: solar, wind, hydroelectric, geothermal, and biomass.
- Identify nonrenewable sources: coal, oil, natural gas, and nuclear energy.
- Compare advantages, limitations, and environmental impacts of energy sources.

4. Representative Energy Case Studies (U.S. + Global)

Students should recognize each facility's energy type, general method of power generation, and scale/impact.

Bhadla Solar Park (India)	Solar Star (California, USA)
Hornsea Offshore Farm (United Kingdom)	Horse Hollow Energy Center (Texas, USA)

Three Gorges (China)	Hoover (Nevada/Arizona, USA)
Hellisheiði Power Plant (Iceland)	The Geysers Complex (California, USA)
Drax Power Station (United Kingdom)	Portland Biomass Energy Facility (Oregon, USA)
Barakah Power Plant (United Arab Emirates)	Palo Verde Generating Station (Arizona, USA)
Tuoketuo Power Station (China)	Gavin Power Plant (Ohio, USA)
Ras Tanura (Saudi Arabia)	Port Arthur Refinery (Texas, USA)
Surgut-2 Power Station (Russia)	West County Energy Center (Florida, USA)

5. Energy Use, Efficiency, and Environmental Impact

- Explain energy efficiency and energy loss in systems.
- Describe environmental impacts of energy production.
- Evaluate tradeoffs between energy sources (cost, reliability, sustainability).

6. Data Analysis and Applications

- Interpret diagrams, charts, graphs, tables, and case study information.
- Apply energy concepts to analyze systems and solve problems.
  Examples:
    - Interpret **energy flow diagrams** to identify energy inputs, transformations, and outputs in a system.
    - Identify energy forms (solar, chemical, electrical, thermal, mechanical, nuclear, gravitational) in real-world scenarios.
    - Analyze diagrams of **power plants** to determine how energy is converted into electricity.
    - Compare renewable and nonrenewable energy sources using charts, tables, and data sets.
    - Interpret graphs showing **energy production, efficiency, cost, emissions, or resource use**.
    - Use maps to identify the best locations for different energy technologies (solar, wind, hydroelectric, geothermal).
    - Analyze case study information from major energy facilities to identify:
        - energy source used
        - energy transformations involved
        - advantages and limitations
        - environmental impacts

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- Energy
- Physics for Kids - Energy
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Genetics

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of genetics, heredity, inheritance patterns, and the relationship between genes and traits.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring: Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Optional - teams may bring: Four-function calculator

Safety Requirements:

- None

The Competition: This event may be administered as a written test or as a series of stations which can include diagrams, models, pedigrees, Punnett squares, data analysis, and problems for students to solve. Content topics will include but are not limited to:

1. Fundamentals of Genetics

- Define and use the terms DNA, chromosome, gene, allele, genotype, phenotype, character, trait, homozygous, heterozygous, dominant, and recessive.
- Describe the relationship between DNA, genes, chromosomes, and inherited traits.
- Explain how genes are inherited from parents and how genotype influences phenotype.

2. DNA and Heredity

- Describe the basic structure and composition of DNA, including nucleotides and complementary base pairing.
- Explain how DNA stores genetic information.

3. Mendelian Genetics

- Understand Mendel's contributions to heredity.
- Explain dominant and recessive inheritance patterns.
- Construct and analyze Punnett squares for monohybrid crosses.
- Determine genotype ratios, phenotype ratios, and probabilities of inheritance.

4. Human Traits and Patterns of Inheritance

- Identify common inherited human traits, including earlobe attachment, tongue rolling, cleft chin, dimples, ACHOO syndrome, and colorblindness.
- Describe inheritance patterns, including autosomal dominant, autosomal recessive, and X-linked recessive inheritance.
- Understand that some traits are simplified classroom examples of Mendelian inheritance, while many human traits are influenced by multiple genes.
- Recognize ACHOO syndrome as an autosomal dominant trait and colorblindness as an X-linked recessive trait.

- Analyze pedigrees and inheritance scenarios to determine possible patterns of trait transmission.

5. Beyond Simple Dominance

- Recognize examples of codominance, incomplete dominance, multiple alleles, and sex-linked traits.
- Compare these inheritance patterns to simple dominant-recessive inheritance.

6. Inherited Traits, Learned Behaviors, and Adaptations

- Distinguish between inherited traits, instinctive behaviors, and learned behaviors.
- Identify examples of inherited characteristics and learned behaviors in plants and animals.
- Explain how inherited adaptations help organisms survive in specific environments.

7. Data Analysis and Applications

- Interpret diagrams, pedigrees, charts, tables, and models related to genetics and heredity.
- Analyze inheritance data and determine likely patterns of inheritance.
- Apply genetic concepts to solve problems and answer scenario-based questions.

Examples:

- Identify and define genetics vocabulary (DNA, gene, chromosome, allele, genotype, phenotype, dominant, recessive, homozygous, heterozygous).
- Interpret diagrams showing the relationship between **DNA → genes → chromosomes → inherited traits**.
- Analyze DNA models to identify nucleotides and complementary base pairs.
- Use DNA sequences or models to determine complementary DNA strands.
- Interpret Punnett squares to predict possible offspring genotypes and phenotypes.
- Calculate genotype ratios, phenotype ratios, and inheritance probabilities from monohybrid crosses.
- Determine whether individuals are homozygous or heterozygous based on genetic information.
- Analyze pedigrees to identify whether a trait is likely **dominant, recessive, autosomal, or X-linked**.
- Determine possible genotypes of family members from pedigree information.
- Predict inheritance patterns for common classroom traits (e.g., earlobe attachment, tongue rolling, dimples, cleft chin).
- Analyze scenarios involving **ACHOO syndrome** as an autosomal dominant trait.
- Analyze scenarios involving **colorblindness** as an X-linked recessive trait.
- Compare inheritance patterns including:
    - simple dominant/recessive inheritance
    - incomplete dominance
    - codominance
    - multiple alleles
    - sex-linked traits
- Interpret tables comparing parental traits and offspring outcomes.
- Analyze case studies to determine whether a characteristic is inherited, learned, or an adaptation.
- Distinguish between:
    - inherited traits (eye color, blood type)
    - instinctive behaviors (bird migration, spider webs)
    - learned behaviors (language, trained behaviors)
- Apply genetics concepts to real-world scenarios involving family inheritance, animal breeding, and plant traits.
- Analyze how inherited adaptations help organisms survive in different environments.

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.

Resources:

- Biology for Kids:Genetics
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Glider

(Coach Scheduled Event - 45 Minutes)

Description: Teams will build and test one glider of any design using the cereal box they bring and the materials provided at the competition. They will also take a written assessment on principals of glider flight.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:	Impact Safety Glasses Required
• **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	 **Eyeglasses are not safety rated!**

Team members must also bring:

- 1-Family size cereal box - approximately 38 cm in height, 20 cm in width, and 7.6 cm in depth. These boxes usually contain between 18-20 ounces of cereal.
- Scissors
- Ruler or straight edge
- Writing utensils

Materials Provided at the Event:

- 1 meter of 1 inch-width masking tape
- 5 - Team choice Paperclips from the following:
  - Jumbo Paperclip 9 cm (3.5 in)
  - Standard size 25 mm (1 in) long
  - Teams may mix the sizes

THE COMPETITION

The Written Assessment: The written assessment will be given during the team's Construction Phase. The team members will answer questions on the principles of glider flight, to include but not limited to Lift, Drag, Weight, Thrust, Airfoil, Bernoulli's Principle, Center of Gravity (CG), Center of Lift (CL), Lift-to-Drag Ratio (L/D), Aspect Ratio, Dihedral, Reflex.

As a part of the assessment the team will estimate the time their glider will stay aloft.

Construction Phase (30 min)

- Teams will build their glider using the cereal box, and the materials provided. They do not have to use all of the materials, but must use at least two paperclips.
- Contestants may test and improve their devices at the discretion of the event supervisor, before their official launch.

- Teams must write their team number on their glider.

Glider Testing:

- Each team will have two official launches of their glider.
- All teams will release their glider from the same launch point marked on the floor of the launch area.
- Teams may not use a running start before they launch their glider. The team's feet must be on the floor when they launch their glider.
- Participants will announce their intention to launch their glider by saying “3, 2, 1, Launch.”
- Time will start when judges see the glider leave the hand of the student.
- The Event Supervisors will record the time a team’s glider stays airborne.
- Timing will continue until the glider touches the top of the launch area, any obstruction, or lands on the floor.
- The Event Supervisor will record all flight times and use the longest time as the official time score for the team. Times will be recorded in seconds to the best precision of the timing device.

SCORING: Final Score (FS) = Assessment Score + Time Score, max = 100 points

- Assessment Score = (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
  - Team Assessment Score (TAS) = the team assessment score
  - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Time Score = (TT ÷ CT) x 50; rounded to the 100th place value; maximum 50 points
  - Competition Time (CT) = the longest flight timing of all teams
  - Team Time (TT) = the time the team’s glider stays in the air

Scoring Example:

- Competition Assessment Score(CAS) = 15. The team scores 9 (TAS) on the assessment.
  Assessment Score for the team= (9 ÷ 15) x 50 = 30 pts
- Competition Time (CT) = 3.56 seconds. The team’s time is 1.45 (TT).
  Time Score for the team= (1.45 ÷ 3.56) x 50 = 20.36 pts
- Final Score (FS) = 30 + 20.36 = 50.36 points

Tiebreakers:

- 1st - The closest estimate to the actual flight time
- 2nd - Written Assessment Score

Resources:

- How to Make Hand Gliders : 7 Steps - Instructables
- Cereal Box Glider w/ Canard and Delta Wing - YouTube
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Hovercraft

(Coach Scheduled Event - 45 Minutes)

Description: Teams will design, construct, and test a balloon hovercraft that levitates on a cushion of air. Choosing their desired ramp and starting position on the ramp, competitors will send their hovercraft down the ramp to stop as close to a finish line as possible, without passing the finish line. Competitors will also complete a written assessment covering hovercraft design, potential and kinetic energy, and friction.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:	Impact Safety Glasses Required
• **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	 **Eyeglasses are not safety rated!**

Team members must also bring:

- Pencils
- Scissors
- Teams may bring a straight edge measuring device
- Students may bring a log of previous hovercraft tests to refer to during their device testing, if desired. No additional notes beyond such a log may be brought into the competition.

Materials Provided at the Event:

- 1 - standard size DVD/CD (12 cm)
- 1 - 20 cm (8 in) balloon
- 7.5 ml to 15ml (1/4 to 1/2 oz) mounting putty
- 1 - 2.7 cm (1.1 in) diameter plastic soda bottle pop top
- 45 cm (18 in) of 2.54 cm (1 in) masking tape
- 1 - 8 ½ in x 11 inch piece of tracing paper
- 1 - 8.5 X 11-inch 60–90-pound card stock paper
- Test Track - see below for parameters

THE COMPETITION

The Written Assessment: The team members will complete an assessment on hovercraft design, potential and kinetic energy, and friction. The assessment will be no longer than 20 questions and will take place simultaneously during the construction of the team hovercraft.

Construction Phase (15 min):

- The team may use any design to create their hovercraft using any or all of the provided materials.

- Teams may request a second balloon if they break their first one, but will not receive any additional beyond that.

The Track:

- The track is in two parts - the ramp and the portion on the floor.
- The ramp will be approximately 20 cm (8 in) wide, 122 cm (48 in) long, and approximately 14 cm (5.5 in) tall at the top, with guide rails measuring 2 cm (¾ in) tall along the sides. The surface of the ramp will be the smooth side of a hardboard wood wall panel (also called MDF).
- Two lengths of wood, 1" x 2" in cross section, will be placed on the floor aligned with the guide rails of the ramp to extend the track onto the floor. These lengths are intended to keep the hovercraft contained when on the floor, and should extend at least 6 feet beyond the end of the ramp.
- A finish line will be marked on the floor side rails. The finish line will be anywhere from 0.5 meters - 1.5 meters from the end of the ramp section.

Hovercraft testing

- The goal of the hovercraft trials is to build the hovercraft and select a starting position on the ramp so that the team's hovercraft travels as close to the finish line as possible, while not crossing it.
- Teams will get two runs and the better of their runs will be used in the event scoring.
- Teams will decide where on the ramp to hold their balloon hovercraft and hold it so that no air escapes. When the Event Supervisor says that they are ready, the team will release the hovercraft on the track.
- When the hovercraft stops, the Event Supervisor will record the distance in cm from the front edge of the hovercraft to the finish line and whether the hovercraft crossed the finish line.
- The team will receive no score for the run if they touch the hovercraft during the run or pick it up before the Event Supervisor can measure its distance.
- The Event Supervisor will not allow teams to compete with their hovercraft if they deem the team's device to be unsafe in any way.

SCORING: Final Score (FS) = Assessment Score + Track Score, max score = 100 points

- Assessment score = (TAS ÷ CAS) x 60; rounded to the 100th place value; maximum 60 points
    - Team Assessment Score (TAS) = team's score on the assessment
    - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Track Score = (CTS ÷ TTS) x 40; rounded to the 100th place value; maximum 40 points
    - Distance Score = Crossing Multiplier x ES-measured distance
        - If the hovercraft finishes before the finish line, the Crossing Multiplier = 1
        - If the hovercraft crossed the finish line, the Crossing Multiplier = 2
    - Competition Track Score (CTS) = the lowest Distance Score for all teams
    - Team Track Score (TTS) = the team's best Distance Score

Scoring Example:

- Competition Assessment Score (CAS) = 15. The team scores 9 on the assessment.
  Assessment Score for the team= (9 ÷ 15) x 60 = 36 points
- On the team's first run, the hovercraft crossed the finish line and was 3 cm from it.
  Distance Score on Run 1 = 2 x 3 = 6
  On the team's second run, the hovercraft finished 10 cm in front of the finish line.
  Distance Score on Run 2 = 1 x 10 = 10
  So Team's Track Score = 6 (the better of the two)
- Competition Track Score (CTS) = 3 (the best of all team's runs)
  Track Score for the team= (3 ÷ 6) x 40 = 20 points
- Final Score (FS) = 36 + 20 = 56 points

Tiebreakers:

- 1st - Best Team Track Score (TTS)
- 2nd - Best Team Assessment Score (TAS)

Resources:

- NASA JPL Education — Make a Hovercraft
- Go Science Girls — Balloon Hovercraft
- Sublime Science — CD Hovercraft
- KiwiCo — Balloon Hovercraft
- The Science Magician — Balloon Hovercraft
- Fab Science — Balloon-Powered Hovercraft
- Science Bob — Tabletop Hovercraft
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Hydraulics

(Coach Scheduled Event - 45 Minutes)

Description: Each team will build a device that uses a hydraulic system to accomplish the task of lifting a 100g weighted object as high as possible while holding the weight for as long as possible. The team will also take a written test on basic hydraulic concepts.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during the entire event.**
- **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.**
- **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**

Impact Safety Glasses Required

Eyeglasses are not safety rated!

Team members must also bring:

- Pencils
- Scissors
- Teams may bring a straight edge measuring device

Materials Provided at the Event:

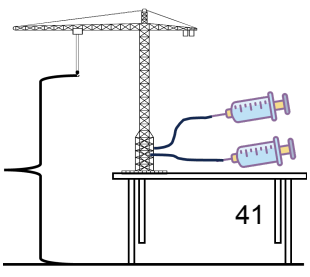
- 1 meter (39 in) of masking tape
- 1 meter (39 in) of 2 mm (0.08 in) string/kitchen twine + enough extra to span the distance between the floor and the table top their device sits upon
- 10 paper-fastener brass brads
- 2-12 ml (0.4 oz) syringes
- 50 cm (19.5 in) of PVC Tubing 3.175mm (⅛ in) inside diameter X 6.35mm (¼ in) outside diameter Flexible Clear Vinyl Hose
- 20 Craft Sticks with Holes 15 cm (6 in)
- 1 Spool ≈ 2.54 cm (1 in) x 1.9 cm (0.75 in) with a center hole ≈ 6 mm (¼ in)
- Water
- 100g mass
- 1 - large paperclip

THE COMPETITION

Written Assessment: The team members will take a test on the principles of hydraulics. The test will occur concurrently with the build.

Construction Phase (30 min):

- Each team will have 30 minutes to construct their device.



- The teams do not have to use all of their materials but at a minimum use both syringes.
- Only those materials provided may be used to build the device.
- The device must be freestanding and may not be attached to a tabletop, floor, ceiling or other support.
- The team will be responsible for filling their syringes and tubing with the supplied water.

Device Testing:

- The 100 gram weight will be placed on the floor, while the team's device will stay on their table.
- The team will tie the end of the string that dangles to the floor to a loop on the weight.
- When ready, with the weight resting on the floor, the team will give a countdown so the Event Supervisor may begin timing. The Event Supervisor will begin the time once the weight lifts off the floor.
- The team will lift the weight with their device and hold it off the floor as long as possible (up to a max of 30 seconds).
- The Event Supervisor will measure the maximum height the weight was lifted. The height will be measured from the floor to the bottom of the weight.
- The Event Supervisor will time how long the weight is lifted off the floor. The maximum time recorded will be 30 seconds.

SCORING Final Score (FS) = Assessment Score + Height Score + Time Score, max = 100 pts

- Assessment score = (TAS ÷ CAS) x 20; rounded to the 100th place value; maximum 20 points
  - Team Assessment Score (TAS) = team's score on the assessment
  - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Height Score = (THS ÷ CHS) x 50; rounded to the 100th place value; maximum 50 points
  - Team Height Score (THS) = the highest distance of lift for all teams
  - Competition Height Score (CHS) = the highest distance of lift over all teams
- Time Score = (TTS ÷ CTS) x 30; rounded to the 100th place value; maximum 30 points
  - Team Time Score (TTS) = team time for weight off the floor (max 30 seconds)
  - Competition Time Score (CTS) = longest time of all teams with weight off the floor (max 30 sec)

Example

- Competition Assessment Score (CAS) = 15
- The team scores 9 (TAS) on the assessment.
  - Assessment Score = (9 ÷ 15) x 20 = 12 points
- Competition Height Score (CHS) = 35 cm
- The team height (THS) is 25 cm
  - Height Score = (25 ÷ 35) x 50 = 35.71 points
- Competition Time Score (CTS) = 27 seconds
- The team's time (TTS) is 1.45 seconds
  - Time Score = (1.45 ÷ 27) x 30 = 1.61 points
- Final Score (FS) = 12 + 35.71 + 1.61 = 49.32 points

Tiebreakers:

1. Best written test score
2. Selected questions on the written test
3. Best Competition Height

Resources:

- Young Engineers: Easy Hydraulic or Pneumatic Machine - Engineering Projects for Kids
- Modern Marvels: Hydraulic Force Transforms Society (S11, E17) | Full Episode | History
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Optics

(Scheduled Event - 30 Minutes)

Description: Participants will be assessed on their understanding of the properties and behavior of light, including reflection, refraction, image formation, color, and optical systems, as well as their ability to apply these principles in a hands-on activity involving mirrors and a laser beam.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring:

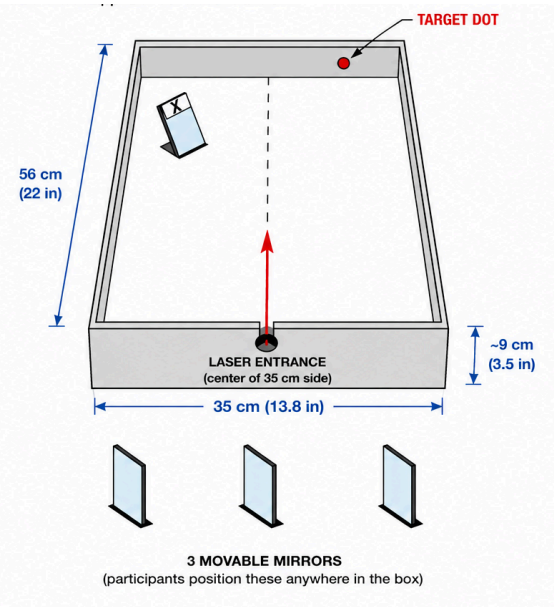
- Pen/Pencil

Teams may bring:

- Four-function calculator
- Protractor & Ruler
- A notecard for use during their laser shoot time to hold in front of the mirrors and aid in seeing where the beam goes when the laser is on.

Laser Shoot (provided at the event):

- A flat-bottom, open box with inner dimensions of approximately 56 cm (22 in) x 35 cm (13.8 in) and a wall height of approximately 9 cm (3.5 in).
- One Class 2 laser pointer mounted through the approximate center of a 35 cm side,, aimed into the box along the midline.
- 4 mirrors
    - Each mirror will be mounted vertically, with a width of 5-8 cm (2-3 in).
    - One mirror will be pre-stationed anywhere and at any angle in the box. This pre-stationed mirror will be marked with an “X” and is not to be moved by the participants.
- Somewhere on the wall opposite the entrance of the laser, a target dot will be taped.



Safety Requirements: None

The Competition: This event includes a written test and a hands-on mirror-positioning activity to direct a laser beam toward a target. Students will be taken from the written test to participate in the laser shoot activity and will return back to their test at the conclusion of their laser shoot time.

Content topics will include but are not limited to:

1. Fundamentals of Light

- Describe the properties of light including transmission, absorption, reflection, and refraction.

- Distinguish between transparent, translucent, and opaque materials.
- Explain how light interacts with matter.

2. Reflection and Mirrors

- Apply the law of reflection.
- Describe image formation by plane, concave, and convex mirrors
- Determine image characteristics including location, orientation, and relative size.

3. Refraction and Lenses

- Explain refraction and its causes.
- Describe image formation by convex and concave lenses.
- Apply simple ray diagrams to determine image characteristics.
- Relate refraction to common phenomena such as magnification and apparent bending of light.

4. Color and the Electromagnetic Spectrum

- Describe visible light as part of the electromagnetic spectrum.
- Relate wavelength and frequency to color.
- Distinguish between additive and subtractive color mixing.
- Explain how objects absorb and reflect light to produce color.

5. Optical Systems and Applications

- Describe the operation of common optical devices including magnifying glasses, microscopes, telescopes, cameras, eyeglasses, and fiber optics.
- Explain how optical principles are applied in everyday technologies.

6. Laser Shoot Activity - 2 minutes

- The angle and location of the stationary mirror will not be revealed until the competitors come to the laser shoot. The location of the target will also be revealed at that time.
- Teams must use at least two mirrors, including the stationary mirror, to direct the laser beam to the target. If desired, the team may use additional mirrors. For a mirror to count as being “used”, the laser beam must reflect off of the mirror; it is not enough for the mirror to simply be present in the box.
- Teams will have a total of two minutes to complete the activity. Within this time, and without disturbing the stationary mirror, teams may adjust movable mirrors before the laser is activated. Teams may use their own protractor when setting additional mirrors.
- The Event Supervisor or designee will activate the laser when asked. Each time the team asks the Event Supervisor to turn on the laser counts as one “try”. Mirrors may not be touched or moved when the laser is on.
    - If the laser does not reflect off the stationary mirror and one additional mirror, no information is recorded, no matter how close to the target the beam falls. It is not a valid attempt, but it still counts as a “try”.
    - If the laser beam hits the target on a valid attempt, the Event Supervisor will stop and record the time used and the number of tries the team attempted to hit the target. The team’s laser shoot is complete.
    - If the laser does not hit the target on a valid attempt, the laser will be turned off and the Event Supervisor will mark with a piece of tape along the wall where the beam hit. The team may elect to make another try at hitting the target.
- When the team decides that they have gotten close enough to the target and does not want to make any more “tries” or when 2 minutes have passed (whichever comes first), the Event Supervisor will measure the distance (to the closest tenth of a centimeter) of the team’s closest try to the target. If the closest try is on a wall other than the wall the Target Point is on, the measurement is the sum of the straight-line measurements along the walls of the box (in other words - it is not a point-to-point measurement). The Event Supervisor will record that distance and the total number of “tries” the team made during their time at the laser shoot.

Scoring:

Final Score (FS) = Assessment Score + Accuracy Score + "Tries" Score

- Assessment score = (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
  - Team Assessment Score (TAS) = team's score on the assessment
  - Competition Assessment Score (CAS) = the highest assessment score for all teams
- Accuracy Score = (TA ÷ CA) x 30
  - Accuracy = 30 – distance measured, the lowest Accuracy is 0
  - Competition Accuracy (CA) = the lowest Accuracy over all teams
  - Team Accuracy (TA) = the team's Accuracy
- "Tries" Score = (CT ÷ TT) x 20
  - Competition "Tries" (CT) = the lowest number of "Tries" for all teams
  - Team "Tries" (TT) = the team's number of "Tries"

Scoring Example:

- Competition Assessment Score (CAS) = 15. The team scores 9 on the assessment.
  Assessment Score for the team= (9 ÷ 15) x 50 = 30 points

- Team was 10 cm from the target, thus Team's Accuracy = 30 - 10 = 20 (TA)
  Competition Accuracy (CA) = 25 (the closest team was 5 cm from the target)
  Accuracy Score = (20 ÷ 25) x 30 = 24 points

- The team took 5 tries (TT). The competition "tries" (CT) was 4.
  "Tries" Score = (4 ÷ 5) x 20 = 16 points

- Final Score (FS) = 30 + 24 + 16 = 70 points

Tiebreakers:

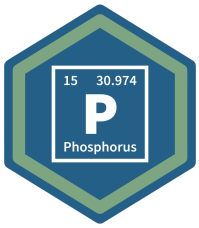
- 1st - the fastest time to hit the target (if the target was hit)
- 2nd - best accuracy score
- 3rd - selected questions from the written assessment

Resources:

- Optics
- Light Waves & Colors
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Periodic Table

(Scheduled Event - 30 Minutes)



Description: Participants will be assessed on their understanding of the periodic table, including structure, element classification, atomic structure, and periodic trends.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring: Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Optional - teams may bring: Four-function calculator

Safety Requirements: None

The Competition: This event will include a written test and may include station-based or hands-on activities involving element identification, periodic table analysis, and data interpretation tasks.

Content topics will include but are not limited to:

1. Periodic Table Structure

- Describe organization by increasing atomic number.
- Identify periods, groups, and major regions (metals, nonmetals, metalloids).
- Identify major families: alkali metals, alkaline earth metals, halogens, noble gases, and transition metals.

2. Atomic Structure and Element Identification

- Define atomic number, atomic mass, protons, neutrons, and electrons.
- Determine subatomic particle counts for neutral atoms.
- Identify elements using atomic number, symbol, and name.

3. Periodic Trends

- Compare trends in atomic radius, electronegativity, ionization energy, and reactivity.
- Predict trends across periods and down groups.
- Use trends to infer element properties.

4. Chemical Behavior

- Explain why elements in the same group have similar properties.
- Relate valence electrons to chemical behavior and reactivity.

5. Data Analysis and Applications

- Interpret periodic tables, charts, and element property data.
- Apply periodic trends to solve problems and classify elements.

Examples:

- Identify elements using **atomic number, chemical symbol, and element name**.
- Use the periodic table to determine the number of **protons, neutrons, and electrons** in neutral atoms.

- Interpret periodic table organization by:

    - atomic number
    - periods (rows)
    - groups/families (columns)
    - metals, nonmetals, and metalloids
- Classify elements as metals, nonmetals, or metalloids based on their location and properties.
- Identify major element families:
    - alkali metals
    - alkaline earth metals
    - transition metals
    - halogens
    - noble gases
- Compare elements within the same group to predict similar properties.
- Use periodic table patterns to predict:
    - atomic size
    - reactivity
    - electronegativity
    - ionization energy
- Analyze charts or data tables comparing element properties to identify trends.
- Determine which element is more reactive based on its location in the periodic table.
- Predict whether an element is likely to form a positive ion, negative ion, or remain stable based on valence electrons.
- Use valence electron information to explain why elements in the same group behave similarly.
- Compare elements across a period to determine changes in properties.
- Interpret element property data (melting point, conductivity, reactivity, atomic size) to classify an unknown element.
- Solve scenario-based problems such as:
    - selecting the best element for a specific use
    - predicting which elements will react
    - identifying an unknown element based on properties

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to competition.

Resources:

- Periodic Table
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Road Scholar

(Scheduled Event - 30 Minutes)

Description: Participants will demonstrate skills in map reading, interpretation, and map construction using road maps and topographic maps.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Teams must bring:

- Pen/Pencil
- Ruler
- Protractor
- Four-function calculator
- Magnifying glass

Materials Provided at Event:

- Virginia road map(s)
- USGS 7.5-minute topographic map(s)
- Blank paper for mapping and scratch work

Safety Requirements: None

The Competition: Participants will answer questions using provided road and topographic maps.

Content topics will include but are not limited to:

1. Map Reading and Interpretation

- Identify and interpret map symbols, keys, and legends.
- Use compass roses to determine direction and bearings.
- Determine coordinates of specific locations.
- Identify boundaries such as counties, states, and other political borders.

2. Distance and Scale

- Calculate distances between locations using map scale.
- Apply scale to real-world distance problems.
- Interpret ratio and bar scales.

3. Topographic Map Skills

- Interpret contour lines to determine elevation and landforms.
- Calculate elevation change between points.
- Determine percent slope between locations.
- Analyze terrain features using elevation data.

4. Road Map Skills

- Determine shortest distance between locations.
- Provide written driving or walking directions using map features.
- Identify locations and features using map legends.

Scoring:

- Points will be awarded for each correct response.

Tiebreakers:

- Ties will be broken by the accuracy or quality of responses to selected questions chosen by the Event Supervisor prior to competition.

Resources:

- Road Scholar
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Rubber Band Helicopter

(Coach Scheduled Event - 45 Minutes)

Description: Contestants will build and test one rubber band helicopter of any design using the materials provided at the competition, as well as take a written test on the principals of rotary flight.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:	Impact Safety Glasses Required
• **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during any competitor's test phase of the competition.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	 **Eyeglasses are not safety rated!**

Team members must also bring:

- Pencils,
- A ruler/straight edge
- Scissors
- A team chart showing testing results for flying a practice helicopter on an 8 ½ in x 11 inch sheet of paper. Minimum requirement: 6 tests with different rubber band sizes, with and without weights.

Materials Provided at Event:

- 1 ≈ 15cm (6 in) Propeller
- 1 ≈ 15cm (6 in) Craft Stick
- 1-Jumbo Paperclip 9 cm (3.5 in)
- 2- Rubber bands – student choice from an assortment of sizes #64, #33, and #19
- 1-Sheet of Card stock ≈22 cm by 30 cm (8 ½ in x 11 in).
- 50 cm of 2.54 cm (1 in) masking tape
- 10 grams (0.35 oz) of plasticine
- Tin split shot fishing weight - .05 ounce
- Pliers

THE COMPETITION

Written Assessment: The team members will take a test on the principles of rotary flight.

As part of the written test, the team will estimate the time their helicopter will stay aloft without touching the highest point in the launch area.

Construction Phase (15 min):

- Teams will build their helicopter using any of the materials provided. They do not have to use all of the materials provided.
- If the team chooses to use the weights, a pair of pliers will be available.
- Rotation of the helicopter (clockwise, counterclockwise, horizontal, or vertical) is a team choice.
- The height of the ceiling will be announced during the building phase.
- Contestants may test their devices in the building area, and at the discretion of the event supervisor, test them from the official launch location.
- Teams must write their team number on their helicopter.
- During the construction phase the team will give the Event Supervisor their estimate for the time that their helicopter will stay airborne without touching the highest point of the launch area.

Helicopter Testing:

- Each team will have two launches of their helicopter.
- Maximum height will depend on the launch area ceiling or obstruction.
- All teams will release their helicopter from a height 1 meter (3.3 ft) from the floor of the launch area.
- Participants will announce their intention to launch their helicopter by saying “3, 2, 1, Launch.”
- Time will start when judges see the helicopter leave the hand of the student.
- The Event Supervisors will record the time a team’s helicopter stays airborne without touching the top of the launch area or any obstruction.
- Timing will continue until the helicopter touches the top of the launch area, an obstruction, or lands on the floor.
- The Event Supervisor will record and average the flight times for both launches. Times will be recorded in seconds to the nearest 1/100.

Scoring:

Final Score (FS) = Assessment Score + Time Score, max = 100

- Assessment Score (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
  - Team Assessment Score (TAS) = the team’s score on the written assessment
  - Competition Assessment Score (CAS) = the highest score on the written test for all teams
- Time Score (CTS ÷ TTS) x 50; rounded to the 100th place value; maximum 50 points
  - Competition Time Score (CTS) = the average longest time of all teams
  - Team Time Score (TTS) = the average time the team’s helicopter stays in the air
- Example
  - Highest Assessment Score across teams (CAS) = 15.
  - The team scores 9 on the assessment (TAS).
  - Assessment Score for the team= (9 ÷ 15) x 50 = 30 points
  - Best Flight Time across teams (CTS) = 1.45 seconds.
  - The team’s flight time is 3.56 (TTS).
  - Time Score for the team= (1.45 ÷ 3.56) x 50 = 20.36 points
  - **Final Score (FS)** = 30 + 20.36 = 50.36 points

Tiebreakers:

- 1st - The closest estimate to the actual flight time.
- 2nd - Completeness of the team chart showing testing. Teams showing more testing details will be ranked above others.
- 3rd - Written Test Score

Resources:

- Instuctables: How to make a helicopter for kids out of a coffee cup.
- University of West Virginia: Rubber Band Helicopter - STEMCARE Lesson
- Rubber Band Helicopters
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Sail Car

(Coach Scheduled Event - 45 Minutes)

Description: Teams will design, build, and race a sail-powered model using wind as their only source of energy, to travel as straight a distance as possible in the shortest amount of time. They will answer questions on a written assessment on their understanding of wind, angles, and aerodynamics.

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Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring: ● **Safety glasses labeled ANSI Z87+ (impact rated)** ● **All competitors must wear their eye protection during any competitor's test phase of the competition.** ● **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** ● **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	Impact Safety Glasses Required  **Eyeglasses are not safety rated!**

Teams must also bring:

- Writing Utensils
- a ruler or straight edge
- one pair of scissors

Materials Provided at the event:

- 4 ≈ 4 cm (1.5 inches) plastic wheels
- 6 ≈ 20 cm (8 inches) paper drinking straws
- 2 ≈7.5 cm (3 inches) cooking skewers
- 2 ≈15 cm (6 inches) cooking skewers
- 4 ≈15 cm (6 inches) craft sticks
- 1 ≈ 8.5 X 11-inch (21.6 cm x 28 cm) tissue paper
- 1 ≈ 8.5 X 11-inch (21.6 cm x 28 cm) 60–90-pound card stock paper
- 1 ≈13 cm by 7.5 cm (5 in x 6 in) piece of cardboard
- 1 meter of 2.54 cm (1 in) masking tape
- 10 grams (0.4 oz) of plasticine

THE COMPETITION

The Written Assessment: The team members will take a written assessment on their understanding of

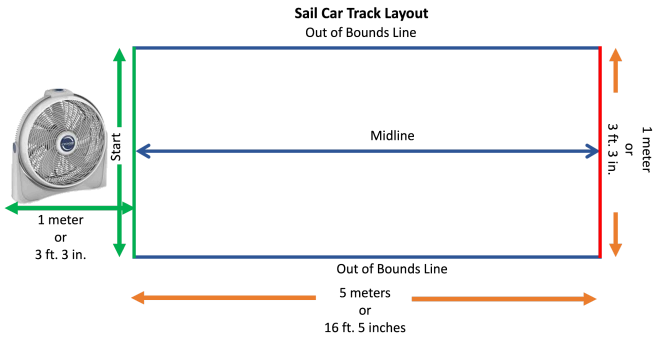
wind, angles, and aerodynamics. The test will take place simultaneously during the construction of the team car.

Construction Phase (30 minutes):

- Teams may cut their materials to any size they deem appropriate, except for the craft sticks which must remain whole
- Teams may use as much or as little of their materials to build their car.
- Teams may have 2 untimed practice runs to test their car within the 30 minutes build time with permission of the Event Supervisor.
- Practice runs will not occur after the 30-minute build time.
- A request for additional materials results in a team being placed in Tier 2. This means that the team may still participate but will be placed below all teams that do not violate this rule
- Releasing a car down the track without permission of the Event Supervisor during both the testing and scoring phases of the competition will result in a team being placed in Tier 2.

The Track:

- The track will be on a relatively smooth, flat, hard surface.
- The track will be 3 meters long, with a width of one meter.
- It will have a start line, end line and a center line.



Official Testing:

- Each team will have one officially scored run.
- The team will prepare and hold their car anywhere behind the start line.
- The team must state that they are ready to turn on the fan and must wait for the Event Supervisor to acknowledge they are ready to time
- At this signal a team member will make a loud announcement of, “3, 2, 1, LAUNCH!” and turn the fan on.
- The Event Supervisor will record the time until the team
- Teams that push their car at any time will be placed in Tier 2.

SCORING:

Final Score (FS) = Assessment Score + Track Score, max score = 100 points

- Assessment score = (TAS ÷ CAS) x 60; rounded to the 100th place value; maximum 50 points
    - Team Assessment Score (TAS) = team’s score on the assessment
    - Competition Assessment Score (CAS) = the highest assessment score for all teams

- Track Score = (CTS ÷ TTS) x 40; rounded to the 100th place value; maximum 50 points
    - Competition Track Score (CTS) = the lowest Track Score for all teams
    - Team Track Score (TTS) = the team’s Track Score
    - Each Track Score = Time + Distance. Want the Track Score to be as low as possible.
        - Distance
            - If the sail car crosses the finish line in bounds, this is the distance (in cm) along the finish line from the midline to where the car crossed the finish line
            - If the sail car crosses out of bounds before the finish line, this is the straight line distance (in cm) from where the vehicle went out of bounds to the midline of the finish line.

            - If the sail car stops before the finish line, but remains in bounds, this is the straight line distance (in cm) from the front edge of the car to the midline of the finish line.
        - Time for the Sail Car's run. Timing ends when the sail car passes the finish line, goes out of bounds, or stops within bounds.
- Tiers
    - Tier 1 - the sail car is not in Tier 2
    - Tier 2 (the lower scoring tier)
        - The team requests additional build materials.
        - The team takes a disallowed practice run.
        - The team pushes their car during their official test.

Scoring Example:

- Competition Assessment Score (CAS) = 15. The team scores 9 on the assessment.
  Assessment Score for the team= (9 ÷ 15) x 60 = 36 points
- Competition Track Score (CTS) = 1.45 seconds + 0 cm = 1.45 (sail car crosses finish at the midline)
  The Team's Track Score (TTS) = 2.56 seconds + 1 cm = 3.56 (sail car stops just short of the finish)
  Track Score for the team= (1.45 ÷ 3.56) x 40 = 17.79 points
- Final Score (FS) = 36 + 17.79 = 53.79 points

Tiebreakers:

- 1st - The team closest to the midline when passing the end line
- 2nd - The better score on the written test
- Select questions on the test

Resources:

- NASA - What Is Aerodynamics?
- Kid Wind – Sail Cars Activity
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Super Sleuths

(Scheduled Event - 30 Minutes)

Description: Teams will receive a crime scenario, a collection of evidence samples, and a list of possible suspects. Participants will perform laboratory tests, analyze physical evidence, and apply scientific reasoning, to identify the most likely suspect(s) and solve the crime.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring:	Indirect Vent Goggles Required
• **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during any competitor's test phase of the competition.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	 **Eyeglasses are not safety rated!**

Teams must bring:

- Pen/Pencil

Teams may not bring:

- Notes or guides of any kind.

Safety Requirements:

- Participants are expected to conduct themselves in a safe and responsible manner at all times.

General Safety Rules

- Follow all instructions provided by the Event Supervisor.
- Do not taste, smell directly, or intentionally ingest any substance provided during the event.
- Do not place any material near the eyes, nose, or mouth.
- Handle all evidence samples carefully and only as directed.
- Report spills, broken equipment, or unsafe conditions immediately to the Event Supervisor.
- Do not remove any materials from the competition area.
- Horseplay, misuse of materials, or unsafe behavior is prohibited.

Safety Penalties

- First minor safety violation: Warning.
- Additional minor safety violations: Up to 10% deduction from the final score per violation.

- Major safety violations (including intentional misuse of materials, tasting substances, or behavior that endangers participants or equipment): Tiered below teams with no major safety violations.
- Repeated or severe unsafe conduct: Disqualification at the discretion of the Event Supervisor.

Materials Provided at Event:

Each team will receive identical evidence samples and testing materials. Participants will be provided with:

- Cups
- Spoons
- Stirrers
- Magnet
- Deionized water
- pH paper
- Magnifying glass
- Crime scenario
- Evidence samples
- Suspect information sheets

The Competition:

1. Qualitative Analysis Station

Teams will identify unknown evidence by performing appropriate tests and observations, including solubility, magnetic properties, acidity (pH), color, texture, other observable characteristics.

- **Powders:** Cornstarch, Baking soda, Gelatin, Yeast, Sand, Ascorbic acid
- **Liquids:** Lemon juice, Hydrogen peroxide, Water, Soap solution
- **Metals:** Iron, Copper, Aluminum

2. Polymer Testing and Natural/Man-Made Substances

Teams will identify and analyze evidence from a variety of natural and manufactured materials.

- **Hair:** Difference between human, dog, and cat hair (microscopic pictures or descriptions will be provided)
- **Fibers:** Difference between animal, vegetable, and synthetic (microscopic pictures, source of fibers, or descriptions will be provided)
- **Recyclable Plastics:** HDPE, PETE, PMMA, PS

3. Other Evidence Analysis

Teams will identify and analyze additional forms of forensic evidence and answer related knowledge questions.

- **Fingerprints:** Identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
- **Shoe/Tire Prints:** Compare prints and make conclusions, including direction and speed.
- **DNA:** Compare DNA chromatograms from materials found on the scene to those of the suspects.

4. Crime Scene Analysis

Teams will use all evidence collected during the event to solve the crime. Participants will prepare a written analysis that:

- Identifies the suspect(s) most strongly supported by the evidence.
- Explains which evidence supports the conclusion.
- Describes how the evidence connects the suspect(s) to the crime.
- Explains why the remaining suspects were eliminated.
- Demonstrates logical and scientific reasoning based on the evidence provided.

Scoring:

- Accuracy of evidence identification
- Interpretation of forensic evidence
- Knowledge-based questions
- Crime scene analysis and conclusions
- Quality of scientific reasoning

Tiebreakers:

- Highest crime scene analysis score.
- Highest evidence identification score.
- Highest DNA analysis score.
- Event Supervisor-selected tiebreaker question(s).

Resources:

- Crime Busters
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Tower Building

(Coach Scheduled Event - 45 Minutes)

Description:

Teams will construct a tower using paper drinking straws and tape. The tower will be evaluated on its height, strength, and engineering knowledge. Towers will be tested using progressively heavier loads to determine the maximum load successfully supported. Teams will also complete a written assessment covering tower design, structural forces, stability, and engineering principles.

Participants per assigned Team Number: 2

- If your school has 1 team you will send 2 students
- If your school has 2 teams you will send 2 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 2 students per team number; team numbers may not intermix

Safety Equipment - Teams Must Bring: • **Safety glasses labeled ANSI Z87+ (impact rated)** • **All competitors must wear their eye protection during the entire event.** • **If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.** • **If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.**	Impact Safety Glasses Required  **Eyeglasses are not safety rated!**

Teams Must Bring:

- Pencil, pen, or marker

Teams May Bring:

- Ruler or straightedge
- One pair of scissors per team member
- Four Function Calculator

Materials Provided at Event:

- 30 - 20 cm (8 in) paper drinking straws
- 1 meter of 2.54 cm (1-inch) masking tape
- One wooden loading block approximately 5 cm × 5 cm × 2 cm (2 in x 2 in x 3/4 in)
- One 50 g (1.8 oz) mass capable of sitting on the loading block
- One 100 g (3.5 oz) mass capable of sitting on the loading block
- One 300 g (10.6 oz) mass capable of sitting on the loading block

THE COMPETITION

Construction Phase (25 minutes):
The tower must:

- Stand freely on a flat testing surface.
- Be constructed entirely from the provided straws and tape. Teams may cut, bend, or crimp the straws and may slide them inside one another. Teams may not bring any preconstructed components or use materials not provided by the Event Supervisor.
- Support the loading block at its highest point.
- Have all structural supports resting directly on the testing surface.
- Remain self-supporting without external assistance. The team may not attach any portion of the tower to the testing surface.

The Written Assessment: Simultaneously with the device testing time, the team will take a written assessment. Teams will be called up from their written assessment to test their device and then will return to their written assessment while other teams test their device. The assessment topics may include:

- Types of towers
- Tower design principles
- Structural forces (tension, compression, shear, torsion)
- Stability and center of gravity
- Load paths and load distribution
- Failure modes
- Engineering applications of towers and tall structures

Device Testing Setup

- At the direction of the Event Supervisor, teams will place their tower on a flat, level testing surface.
- No sticky surface of the tape may contact the testing surface.

Device Testing Measurements

- Before testing, the Event Supervisor (ES) will record:
    - Tower height to the nearest millimeter - Tower height will be measured vertically from the testing surface to the highest point capable of supporting the loading block. The loading block is not included in the height measurement.
    - Number of unused, complete straws - A complete straw is one that remains uncut and unmodified.
    - If a tower is freestanding and can hold the loading block. Towers that are neither freestanding or able to hold the loading block will be tested to the best of the Event Supervisor's ability in order to give the team the experience, but will score zero for both the Height and the Load Score.

Load Testing

- Teams will place the loading block on the tower at its highest supported point.
- Teams will then test their tower using progressively heavier loads.
    - 50 g (1.8 oz) mass for 30 seconds
    - 100 g (3.5 oz) mass for 30 seconds
    - 300 g (10.6 oz) mass for 30 seconds
- A load is considered successfully supported if:
    - The tower remains standing.
    - The load remains supported.
    - The loading block remains supported.
    - No portion of the tower touches the tabletop except its intended base supports.

        - Thirty seconds elapse without failure.
- Testing ends when:
    - The tower collapses.
    - The load falls.
    - The loading block falls.
    - The tower is touched by competitors after testing begins.
    - Any portion of the tower contacts the tabletop other than its intended base supports.

SCORING: Final Score (FS) = Height Score + Load Score + Assessment Score

- Height Score = (TH ÷ CH) x 40, maximum is 40 pts
    - TH (Team Height) = Measured height of the team's tower
    - CH (Competition Height) = Height of the tallest freestanding tower able to hold the loading block
- Load Score = (TL ÷ CL) x 40, maximum is 40 pts
    - TL (Team Load) = the maximum number of grams of the load successfully supported by the team's tower (either 50, 100 or 300)
    - CL (Competition Load) = the maximum number of grams of the load supported by any freestanding tower
- Assessment Score = (TAS ÷ CAS) x 20, maximum is 20 pts
    - TAS (Team Assessment Score): Team written assessment score
    - CAS (Competition Assessment Score): Highest written assessment score across teams

Scoring Example

- Team's height (TH) = 12 cm. The Competition Height (CH) = 15 cm
    - Height Score = (12 ÷ 15) x 40 = 32 points
- The team's tower (TL) held 300 g. That was the most of all the teams, so CL = 300.
    - Load Score = (300 ÷ 300) x 40 = 40 points
- Competition Assessment Score (CAS) = 10. The team scores 6 on the assessment (TAS).
    - Assessment Score for the team= (6 ÷ 10) x 20 = 12 points
- Final Score (FS) = 32 + 40 + 12 = 84

Tiebreakers:

- Number of unused straws
- Select test questions

Resources:

- Building for Hurricanes: Engineering Design Challenge
- Teach Engineering - Straw Towers to the Moon
- Science Teachers & Librarians
- Get permission from your parents/coach to use AI to create a study guide using the rules provided here

Materials Overview

This list is given as an aid to viewing overall event needs. The rules and any published changes supersede this list if there are any discrepancies.

EVENT	# OF PARTICIPANTS	SAFETY GLASS labeled ANSI Z87+ (impact rated)	PARTICIPANTS MUST BRING	PARTICIPANTS MAY BRING (OPTIONAL ITEM)	MATERIALS PROVIDED AT EVENT	NOTES
3rd Grade - Balloon Racer	2 per team number	Impact Safety Glasses	• Writing Utensils • One pair of scissors	None	• 3- 30 cm (12 in) Balloons • 1 - Paper Smoothie straw - 10 mm (0.4 in) diameter, 23 cm (9 in) length (wide opening) • 2 - Paper straws - 6 mm (0.24 in) diameter, 20 cm (7.75 in) length • 3 - #16 Rubber band • 1 - 22 cm by 30 cm (8 ½ in x 11 in) 60 to 90 pound cardstock • 50 cm (20inches) of 2.54 cm (1 in) masking tape • Competition Track and a similar Practice Track • Balloon inflater	None
3rd Grade - Biomes	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None
3rd Grade - Human Body	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None
3rd Grade - Picture This	3 per team number	None	• Two black dry-erase markers	• Dry-erase boards (approx. 22 cm × 27 cm) • A event supervisor		None

				term list (same order for all teams)		
3rd Grade - Truss Bridge	2 per team number	Impact Safety Glasses	• Pencil, pen, or marker • Ruler or straightedge • A pair of scissors per team member	None	• 30 paper drinking straws approximately 20 cm (8 in) each • 1 meter (36 in) of 2.54 cm (1 in.) tape • Two support blocks cut from commercial 2 x 4 lumber, of approximately 30 cm (11.8 in) long • One wooden loading block approximately 5 cm × 5 cm × 2 cm (2 in x 2 in x 3/4 in) • One 300 g (11 oz) mass • One 500 g (18 oz) mass	None
Anatomy - Digestive System	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None

Astronaut Lander	2 per team number	Impact Safety Glasses	• Team's "Astronaut Lander Materials Shopping List" with the cost of materials calculated (The Shopping List is a separate page printed in these rules.)
			• Writing utensils
			• Scissors
				• Four-function calculator	• (Free, must be used) 1 - piece of cardboard, approximately 10 x 13 cm (4 in x 5 in)
					• (Free, must be used) 1 - 147 ml (5 oz paper cup) the capsule
					• (Free, must be used) 1- 2.54 cm diameter (1 in) Bouncy Ball
					• ($5 each) 3 - index cards 8 x 13 cm (3 in x 5 in)
					• ($0.50 per cm) Up to 100 cm (39 in) of string
					• ($5 each) 3 - rubber bands, choose from length sizes #64, #33, #19, sizes may be mixed
					• ($5 each) 4 - 20 cm (8 in) paper straws
					• ($0.50 per cm) Up to 100 cm (39 in) of 2.54 cm (1 in) masking tape
					• ($10 each) 10 - mini marshmallows 6 cm diameter x 9 cm height (0.23 in x 0.35 in)
					• Student choice of coffee filters up to 4:
					  ○ ($5 each) Size #1 1 cup
					  ○ ($5 each) Size #2 2-6 cups
					  ○ ($10 each) Size #4 8-12 cups
					  ○ ($15 each) Size #6 Very large capacity
						None

Astronomy - Stellar Evolution	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None

Bungee Drop	2 per team number	Impact Safety Glasses	• Pen/Pencil	• Ruler or meter stick • Scissors	• An assortment of rubber bands, sizes #64, #33, #19, and #117B. • 50 cm (19.5 in) of 2.54 cm (1 in) masking tape	None
Codebusters	3 per team number	None	• Pen/Pencil	• Four-function calculator • VASO Division A Codebuster Resources Sheet	• Work space sheets and scratch paper • VASO Division A Codebusters Resources Sheet	None
Energy	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None
Genetics	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None

Glider	2 per team number	Impact Safety Glasses	• 1-Family size cereal box - approximately 38 cm in height, 20 cm in width, and 7.6 cm in depth. These boxes usually contain between 18-20 ounces of cereal.
			• Scissors
			• Ruler or straight edge
			• Writing utensils
				None	• 1 meter of 1 inch-width masking tape
					• 5 - Team choice Paperclips from the following:
					  ○ Jumbo Paperclip 9 cm (3.5 in)
					  ○ Standard size 25 mm (1 in) long
					  ○ Teams may mix the sizes
						None

Hovercraft	2 per team number	Impact Safety Glasses	• Pencils • Scissors • Teams may bring a straight edge measuring device	• Students may bring a log of previous hovercraft tests to refer to during their device testing, if desired. No additional notes beyond such a log may be brought into the competition.	• 1 - standard size DVD/CD (12 cm) • 1 - 20 cm (8 in) balloon • 7.5 ml to 15ml (1/4 to 1/2 oz) mounting putty • 1 - 2.7 cm (1.1 in) diameter plastic soda bottle pop top • 45 cm (18 in) of 2.54 cm (1 in) masking tape • 1 - 8 ½ in x 11 inch piece of tracing paper • 1 - 8.5 X 11-inch 60–90-pound card stock paper • Test Track - see below for parameters	None
Hydraulics	2 per team number	Impact Safety Glasses	• Pencils • Scissors • Teams may bring a straight edge measuring device	None	• 1 meter (39 in) of masking tape • 1 meter (39 in) of 2 mm (0.08 in) string/kitchen twine + enough extra to span the distance between the floor and the table top their device sits upon • 10 paper-fastener brass brads • 2-12 ml (0.4 oz) syringes • 50 cm (19.5 in) of PVC Tubing 3.175mm (⅛ in) inside diameter X 6.35mm (¼ in) outside diameter Flexible Clear Vinyl Hose • 20 Craft Sticks with Holes 15 cm (6 in) • 1 Spool ≈ 2.54 cm (1 in) x 1.9 cm (0.75 in) with a center hole ≈ 6 mm (¼ in) • Water	None

					• 100g mass • 1 - large paperclip	
Optics	2 per team number	None	• Pen/Pencil	• Four-function calculator • Protractor & Ruler • A notecard for use during their laser shoot time to hold in front of the mirrors and aid in seeing where the beam goes when the laser is on.	• Laser Shoot	None
Periodic Table	2 per team number	None	• Pen/Pencil	• Four-function calculator	None	None
Road Scholar	2 per team number	None	• Pen/Pencil • Ruler • Protractor • Four-function calculator • Magnifying glass	None	• Virginia road map(s) • USGS 7.5-minute topographic map(s) • Blank paper for mapping and scratch work	None

Rubber band helicopter	2 per team number	Impact Safety Glasses	• Pencils, • A ruler/straight edge • Scissors • A team chart showing testing results for flying a practice helicopter on an 8 ½ in x 11 inch sheet of paper. Minimum requirement: 6 tests with different rubber band sizes, with and without weights	None	• 1 ≈ 15cm (6 in) Propeller • 1 ≈ 15cm (6 in) Craft Stick • 1-Jumbo Paperclip 9 cm (3.5 in) • 2- Rubber bands – student choice from an assortment of sizes #64, #33, and #19 • 1-Sheet of Card stock ≈22 cm by 30 cm (8 ½ in x 11 in). • 50 cm of 2.54 cm (1 in) masking tape • 10 grams (0.35 oz) of plasticine • Tin split shot fishing weight - .05 ounce • Pliers	None
Sail Car	2 per team number	Impact Safety Glasses	• Writing Utensils • A ruler or straight edge • One pair of scissors	None	• 4 ≈ 4 cm (1.5 inches) plastic wheels • 6 ≈ 20 cm (8 inches) paper drinking straws • 2 ≈7.5 cm (3 inches) cooking skewers • 2 ≈15 cm (6 inches) cooking skewers • 4 ≈15 cm (6 inches) craft sticks • 1 ≈ 8.5 X 11-inch (21.6 cm x 28 cm) tissue paper • 1 ≈ 8.5 X 11-inch (21.6 cm x 28 cm) 60–90-pound card stock paper • 1 ≈13 cm by 7.5 cm (5 in x 6 in) piece of cardboard • 1 meter of 2.54 cm (1 in)	None

					masking tape • 10 grams (0.4 oz) of plasticine	
Super Sleuths	2 per team number	Indirect Vent Goggles	• Pen/Pencil	None	• Cups • Spoons • Stirrers • Magnet • Deionized water • pH paper • Magnifying glass • Crime scenario • Evidence samples • Suspect information sheets	None
Towers	2 per team number	Impact Safety Glasses	• Pencil, pen, or marker	• Ruler or straightedge • One pair of scissors per team member • Four Function Calculator	• 30 - 20 cm (8 in) paper drinking straws • 1 meter of 2.54 cm (1-inch) masking tape • One wooden loading block approximately 5 cm × 5 cm × 2 cm (2 in x 2 in x 3/4 in) • One 50 g (1.8 oz) mass capable of sitting on the loading block • One 100 g (3.5 oz) mass capable of sitting on the loading block • One 300 g (10.6 oz) mass capable of sitting on the loading block	None