2025-2026
Division A Virginia Science Olympiad

Exploring the World of Science

Competition Dates

April 18 – Oakton High School

April 25 – Lake Braddock High School

Updated: September 1, 2025

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2025-2026 Competition Rules

Spirit of the Problem

- The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Science Olympiad expects students to make an honest effort to follow the rules and the spirit of the problem, not interpret the rules for an unfair advantage.
    - Most simply stated *– If you do not see/read it in the rules it is not allowed, and these rules do not imply that anything outside of them will follow the spirit of the problem.*
- Science Olympiad, VASO, and Division A will not issue any clarifications to the rule written herein.
    - Except for grammar, punctuation, and spelling.
- It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.
- Participants are expected to maintain a positive and respectful attitude throughout the competition.
- Disruptive behavior by students, coaches, mentors, or parents will not be tolerated.
- Students will face automatic disqualification from an event for belittling or mocking the work of other participants, as determined by judges.
- Students caught cheating or interfering with another team's work during an event will be automatically disqualified from that event.

Key Roles: Adults and Participants in Science Olympiad

- VASO Committee: This dedicated committee develops engaging events, secures competition venues, organizes tournaments, coordinates volunteers for the competition and recognizes student achievements with awards.
- Head Coach: The designated leader responsible for the overall direction of the school's Science Olympiad team. They are assigned or appointed by the school sponsor.
- Assistant Coach: A reliable adult who supports the head coach with team responsibilities.
- School Sponsor: The principal or their designated representative who approves the team's formation, facilitates practice space arrangements, and assists with registration paperwork.
- Event Writer: An individual requested by VASO to develop competition tests based on the official rules.
- Event Supervisor: The individual responsible for overseeing and grading a specific event during the competition, either by appointment or volunteer.
- Participant (also referred to as student or competitor): Any student in grades three through five officially registered by their parent and base school to participate in Science Olympiad.
- Third grade participant: A third-grade participant is a student currently enrolled in the base school who is in the third grade. These students have the option to compete in any event offered or specifically in events designated for third graders only. Conversely, while third-grade students can participate in all events, students in the fourth or fifth grade are not eligible to compete in third grade only events.
- Mentor: A reliable adult who guides students in researching information for the competition, with responsibilities distinct from the coaches.
- Chaperone: A reliable adult who assists students with navigating event locations on competition day.
- Volunteer: An individual designated by the coach to assist with the execution and scoring of events at the competition. Additional opportunities may be available based on VASO's needs.

Science Olympiad Code of Ethics

The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the

rules and the spirit of the problem (not interpret the rules so they have an unfair advantage). Failure by a participant, coach, or guest to abide by these codes, accepted safety procedures, or rules below, may result in an assessment of penalty points or, in rare cases, disqualification by the competition director from the event, the competition, or future competitions.

Students' Pledge

I pledge to put forth my best effort in the Science Olympiad competition and to uphold the principles of honest competition. In my events, I will compete with integrity, respect, and sportsmanship towards my fellow competitors. I will display courtesy towards Event Supervisors and Competition Personnel. My actions will exemplify the proud spirit of my school, team, and state.

Coaches' Pledge

On behalf of the coaches and assistants at this competition, I pledge to encourage honesty and respect for competition personnel, our fellow coaches, and other team members. We want our efforts to bring honor to our community and school.

Parents' Pledge

On behalf of my child and spectators I pledge to be an example by:

- Respecting the rules of Science Olympiad.
- Encouraging excellence in preparation and investigation.
- Supporting independence in design and production of all competition devices.
- Respecting the decisions of event supervisors and judges.
- Our examples will promote the spirit of cooperation within and among all our participating teams.

Event Supervisors' Pledge

On behalf of my fellow supervisors and competition personnel, I pledge to run my event with fairness and respect for the participants and their coaches. Our actions will reflect the principles of the Science Olympiad program and display the pride we feel as representatives of our colleges, universities, companies, states or organizations.

General Information:

- In Division A we believe that young scientists must have control of their own efforts and that any interpretation outside of the spirit of the problem is a detriment to their exploration as a learner. We further believe that participants must have control over their own ideas and that trial and error produces lifelong learners.
- The times for written tests are predetermined by the team schedule and are non-negotiable for any team. Building events, however, are scheduled by the coach and are subject to student and space availability.
- Students may participate individually in events where teams/coaches feel it feasible.
- Eye protection is mandatory for building events and events where liquids are present. The correct eye protections for events are listed in the rules and at the before the competition schedule. We do not have any events that require lab or protective clothing, but students may wear this if they wish.
- Coaches and Assistant Coaches are responsible for completing the registration formalities including providing the required number of volunteers and scheduling their teams' building event times.
- Parents will be allowed in team areas only. They may not enter the testing or building competition sites except when acting as the team's designated chaperone. We will ask any Parents found violating this rule to leave immediately and will ask them to leave the building on a second offence.
- VASO will never run an event with less than two supervisors in the room.
    - Each event supervisor and volunteer of an event will help until all examinations are graded, winners determined, and scores entered into the scoring system. For all event supervisors this is the entire competition for their event.

- Event Supervisors and volunteers must follow the same safety protocols as the participants and must ensure that all participants are always following the safety protocols. Wear your goggles and safety glasses!
- Test writers will provide plans/assessments one month prior to the competition for review.
- All coaches, assistant coaches and event supervisors must be reachable for the entire competition day.

2025-2026 Division A Tournament Coach Support Timeline & Checklist

- ☐ **Tues. Sept. 2 -** Event Rules Released on VASO Website; Registration Opens
- ☐ **Sat. Sept. 20** - Coach Meeting (Zoom)
- ☐ **Sat. Oct. 11** - New Coach Q&A (Zoom)
- ☐ **Fri. Jan. 9** - **Registration Closes**
- ☐ **Fri. Jan. 30** - Coaches Notified of Assigned Tournament Date and Time
- ☐ **Sat. Jan. 31 at 7 AM** - Volunteer Signup Opens for shift work on behalf of team Send volunteers here to sign up, and then track your volunteers here *Remember that parent volunteers cannot sign up to help in an event if their student is competing in that event. HS students are permitted to volunteer.*
- ☐ **Wed. Feb. 18** - Coach Meeting (Zoom)
- ☐ **Wed. Feb. 18 at 7 PM** - Building Event Signup Opens - Sign up your teams for their self-schedule event time slots. *This signup is not available until your team's volunteer ask is* ***fulfilled****.*
- ☐ **Sat. Feb. 28 at 5 PM** - **Volunteer Signup Closes**
- ☐ **Fri. March 13** - Volunteer Assignments Released
- ☐ **Fri. March 27 at 5 PM** - **Building Event Signup Closes**
- ☐ **By Fri. March 27** - Update team names for use in scoresheets and awards ceremony
- ☐ **By Wed. April 8 at 5 PM** - Formalize your roster. Permission form for each student must be submitted by parent/legal guardian; students will not be allowed to compete without this.
- ☐ **By Wed. April 8 at 5 PM** - Confirm which coaches are attending tournament in Portal
- ☐ **Wed. April 8** - Final Coach Meeting Before Tournament

April 18- Oakton Division A Tournament **April 25-** Lake Braddock Division A Tournament

2025-2026 Division A Registration Prices

REGISTRATION DISCOUNTS

Economically Disadvantaged Student Populations

VASO offers a 50% registration fee discount to any school that meets one or more of the following criteria:

- is classified as a Title I school
- adopts the Community Eligibility Provision (CEP)
- has 49% or more of their students eligible for free or reduced meal pricing

DETERMINING YOUR VASO REGISTRATION FEE:

1. Determine how many teams the school will be fielding. Schools may field up to three tournament teams.

2. Determine the school's discount eligibility (see box above).
   VDOE data on free or reduced meal pricing can be found here from the 2024-2025 school year.

3. Look up the registration fee on the table below. *Coaches may also confirm their registration fee in the VASO Portal after creating their account and inputting their number of teams once registration opens.*

Payments will be accepted via check or credit card/PayPal once registration opens.

2025-2026 DIVISION A REGISTRATION			
	1 Team	**2 Teams**	**3 Teams**
Standard Registration Fee	$280.00	$470.00	$660.00
Economically Disadvantaged Discount	$140.00	$235.00	$330.00

Registration Formalities:

2025-2026 Division A Registration Steps

To be fully registered for the 2026 competition season, teams **must** complete the following steps no later than **Friday, January 9, 2026**. Registration opens **Tuesday, September 2.**

☐ 1. Head coach completes this Google form with basic school and coach information. *When this is completed, you should receive an automated confirmation email to the email address you provided in the form.*

☐ 2. Head coach (and assistant coach or school-based sponsor, if applicable) makes an account in the VASO Div A Coach Portal. Accounts are not active until approved by VASO. This is done to protect the student data in the accounts. No more than three accounts per school will be approved.

☐ 3. Head coach completes and emails the two required school registration forms to registration@virginiaso.org. *Both forms require the signature of the school's head principal.*

☐ 4. After the Coach Portal account is approved, the head coach enters in the number of teams they are registering to the VASO Div A Coach Portal and generates an invoice. *This invoice can then be shared with school finance offices that may require this documentation to approve payment.*
Number of teams cannot be changed after January 9.

☐ 5. Invoice is paid via the VASO Portal Invoices Page. *No login is required to access this page of the Portal to submit payment, so this can be completed by any person authorized by your team or school. Payment can be submitted via PayPal/credit card (preferred) or by check.*

☐ 6. Head coach enters their preferences for tournament date and time via the VASO Div A Coach Portal. *Tournament assignments will be finalized and communicated by January 30, 2026.*
The following steps will need to be completed as part of tournament preparation but are not required to be completed by January 9 to be fully registered with VASO.

☐ 7. Teams are required to sign up two volunteers for their tournament date via the VASO Div A Volunteer Portal. The volunteer signup opens January 31 and closes February 28. Teams will not be able to sign up for build event time slots (which opens February 18) until their required number of volunteer shifts are filled.

☐ 8. Parents sign the student permission form on the VASO website. *No login is required for parents to do this. Coaches will be able to see who has filled this out from their team via the VASO Coach Portal. Students cannot participate in the tournament without having the permission form completed.*

Roles & Responsibilities

- **Head Coaches and Assistants**

Who can Compete:

- Any student in grades three through five officially **registered by their parent and base school to participate in Science Olympiad**. Students in grade 5 may choose to participate in either Division A or Division B. They may NOT compete in both divisions in the same school year.
    - Coaches will register the school and team by following the steps outlined under Coach's Roles and Responsibilities
    - Parents will register the student by filling out the VASO online registration when asked by the Coach
- Students from different schools that attend the same after school or weekend activity may not enter as a team.
- Science Olympiad will recognize home schooled teams consisting only of students who live within the boundaries of two contiguous (side-by-side) geographic counties in Virginia.
- Division A reserves the right to turn away any schools, students, or parents that do not complete the forms by the published deadlines and will refund registration fees of teams turned away.

Setting up the Team:

- Teams must have one Head and one Assistant Coach
- A team is defined as a group of fifteen or less students residing within the same school attendance zone and attending the same school.
- A school may have up to 3 teams. Schools will receive numbers and wrist bands for each rostered team registered. *Students listed on one roster may not compete with a student on another team roster.*
    - If your school has 1 team you will have one team number and may send 2 students per event or as specified in the rules.
    - If your school has 2 teams you will have two team numbers and may send 2 students per team number; team numbers may not intermix.
    - If your school has 3 teams you will have three team numbers and may send 2 students per team number; team numbers may not intermix.
- Students in grades 3-5 are eligible to participate in Division A. Smaller groups within a team may be a mix of students from different grade levels, or they may be based on grade level with students all coming from the same grade level.

Team Management:

- Coaches are responsible for ensuring that all students, mentors, chaperones, and parents associated with their school understand and adhere to the competition's expectations for positive conduct. Coaches should clearly communicate these expectations beforehand.
- Coaches are responsible for receiving and answering communication from Virginia Science Olympiad in a timely manner.
- Answer questions about the rules of all events from the students, parents, and mentors
- Coaches are the only adults that may talk to the competition committee on the competition day. Being reachable on competition day is mandatory.

Assigning & Scheduling Events:

- When selecting student pairs, it is advisable that you select students that you know will work well together in a team situation. Both should be equal members of a partnership. If one member dominates the partnership, the two will most likely not work well on the day of the competition.

- As written event times are set, assign those before assigning coach scheduled building events.
- Create a competition day schedule for all students to follow
- Choose times for all Coach scheduled events through the portal.
- Ensure there are no time conflicts for all students.
- Third grade only events are for third graders. A fourth or fifth grader cannot compete in those events even when paired with a third-grade student.
- Third grade students can compete in all the events. Special consideration will not be given when they compete in events open to fourth and fifth grade students.
- Fifth grade students may choose to participate in either Division A or Division B. They may NOT compete in both divisions in the same school year.
- Students may leave when they have completed their events and return for their awards.

Providing Volunteers:

- Find volunteers and have them sign up as volunteers using the appropriate forms online.
- All teams will provide at least two volunteer names per registered team at least three weeks before the competition. (2 school teams equal four volunteers.) Teams will not receive team numbers or be able to schedule building event times until this requirement is met.
- Ensure parents that volunteer will not be an Event Supervisor or judge for their child's event.
- Coaches can volunteer to run an event as well. If you decide to volunteer, have someone sign up as an Assistant Coach so they can be the point of contact for both students and the VASO committee.
- Schools will not receive their medals if they do not meet their volunteer obligations, this includes if their volunteers do not show to help with the competition.

Designating Chaperones:

- The coach designates team chaperones, they are the only adults that may walk students to and from events.
- Each team will receive two chaperone badges. These may be passed from parent to parent throughout the day but MUST always be visible.
- Chaperones are not allowed to loiter in the competition area after walking the students to and from events.

Managing Mentors & Parents:

- Teams may have mentors that may participate outside the team structure by tutoring students in events. They do not have any say in the makeup of the team or the scheduling of events. They will ask the team coach for interpretations of the rules. They may not discuss events with Virginia Science Olympiad or Event Supervisors.
- Parents who are not volunteers and are not actively involved in running an event at the tournament are not allowed in competition areas. They may not discuss events with Virginia Science Olympiad or Event Supervisors. It is the coach's responsibility to ensure that parents remain in team spaces.

Student Safety:

- Responsible for monitoring the safety of all students working with mentors and other adults
- Work with school administration and/or sponsor to book spaces for team practices during the school year
- Ensure that students procure mandatory safety glasses and or equipment required for competing and bring them to the competition

Submitting Appeals:

- Division A competitions provide a safe space for students to have fun and express their scientific thinking.
- Appeals to the VASO Committee for any event must involve only the students directly affected and one coach.
- VASO does not permit appeals of individual knowledge assessment questions.
- Students must submit written event appeals in person (using official forms), with their Head Coach or Assistant Coach, to the competition director or their representative within 30 minutes of their event session ending. VASO will not discuss appeals with mentors, parents, or team volunteers.
- The competition will address appeals in the order received and resolve them on the competition day.

Collecting Medals:

- A coach or designated adult representative from each school *must* be present at the awards ceremony.
- The coach is solely responsible for collecting all medals won by their school's participants. This includes collecting medals for absent students for subsequent distribution or allowing students who are present to collect their own awards.
- VASO will not accommodate requests for medals to be mailed or delivered after the awards ceremony.

- **Students:**

  Event Participation: To ensure a successful and positive experience for everyone, please adhere to the following guidelines:
  - Know Your Team: Remember your assigned Team Number.
  - Essential Materials: Bring all mandatory materials required for your events.
  - Punctual Check-in: Report to your competition site at least five minutes before your scheduled event time for check-in.
  - Identification on Materials: Make sure to clearly write your team number on all tests and submitted materials.
  - Safety First: If the rules specify, bring all mandatory safety equipment to your event.
  - Return to Team Area: Once you have completed your event, promptly return to your designated team space.

  General Conduct:
  - Positive Attitude: Maintain a positive and respectful attitude throughout the entire competition.
  - Respect for Others and Property: Treat all individuals and competition facilities with respect.
  - No Disruptive Behavior: Any disruptive behavior, including belittling or mocking other students or interfering with their work during the competition, will result in disqualification.
  - Academic Integrity: Cheating will not be tolerated under any circumstances.
  - Sportsmanship: Display good sportsmanship during the awards ceremony, win or lose.

- **Event Writers**
  - Writing an event involves creating a hands-on activity or written assessment based on the rules set forth in this event manual
  - Test writers will provide plans/assessments one month prior to the competition for review
  - Division A will only reimburse Test Writer expenses that the Division A treasurer approves before the purchase of materials for running an event at the competitions.

- **Event Supervisors**
    - Adhering to Rules: Event supervisors must familiarize themselves with the event rules and with the Code of Ethics, General Rules, and Scoring Policies.
    - Event Preparation: They are responsible for setting up the testing area, inventorying provided materials, and coordinating with other volunteers for their event.
    - Test Administration: Event supervisors administer tests, oversee lab activities, and ensure the event is conducted fairly and efficiently.
    - Scoring and Reporting: They are responsible for scoring tests, inputting scores into spreadsheets, and submitting final event results.
    - Student Support and Encouragement: Event supervisors should encourage and challenge students in a professional and friendly manner, answering questions and ensuring they understand the rules.
    - Safety: They are responsible for enforcing safety precautions and providing instructions on how to clean up laboratory spaces.
    - Tie Breaking: They are responsible for breaking ties and indicating how the tie was broken on the student answer sheets and score sheets.
    - Coordinating with Officials: Event supervisors will coordinate with competition day directors.
    - Addressing Issues: They are responsible for addressing any issues, cheating, or unsportsmanlike behavior, and notifying competition day directors. The competition directors will decide on how best to move forward.
    - Maintaining Accuracy: Event supervisors must ensure accuracy in scoring, ranking, measuring, and submitting results.
    - Event Logistics: They will assist with tasks like checking in students to their event, checking wristbands, and ensuring teams have the necessary materials.

- **Volunteers**
    - The Division A Competition cannot run without parents, teachers, students, and mentor volunteers helping on competition days. Volunteers will assist the Event Supervisor in the smooth running of the event
    - All teams will provide at least two volunteer names per registered team at least three weeks before the competition. (2 school teams equal four volunteers.) Teams will not receive team numbers or be able to schedule building event times until this requirement is met.
    - If a school does not find volunteers the coach or assistant coach may volunteer to run an event to meet this requirement.
    - All volunteers must sign up for your team through the VASO registration site
    - Volunteers should not sign up for helping with the event their child is participating in
    - Volunteers are not expected to be experts in the event of their choice but are required to understand the event rules and act accordingly
    - Attend the volunteer training ahead of competition day. It might be either virtual or in person.
    - Volunteers must check in at the VASO office for their assignment.
    - Volunteers will/might be asked
        - Prepare for the event by familiarizing themselves with the rules of their event and have all their questions answered prior to the tournament
        - Help administer the event: Set up, Clean up, Scoring
        - Check in students - checking the wristband, ensuring students have the mandatory materials (safety glasses) and send them to procure those, if needed before the event
        - Proctor tests
        - Act as timekeepers or measure height, weight, etc. depending on the event rules
        - Clean up
        - Correct the tests using the key provided

- **Parents and Families**

To help ensure a fair, positive, and enriching experience for all participating students, we ask that parents and families embrace the following responsibilities:

Supporting Your Child's Participation:

- Timely Forms: Please complete the online parent permission form promptly when requested by the coach.
- Focus on Their Experience: Understand that this competition is for your child's growth and learning. Encourage their research and preparation but remember to allow them time for other aspects of childhood and avoid excessive pressure.

Maintaining a Fair and Respectful Competition Environment:

- Respectful Observation: Refrain from entering competition areas or communicating with team members at any time during the competition. Please do not interfere with event judging or discuss event administration with Event Supervisors.
- Consequences of Interference: Any interference may unfortunately lead to your child's disqualification from the event and potentially the entire competition. Division A reserves the right to ask any parent who is interfering to leave the competition venue.

Contributing to the Success of the Event:

- Volunteer Support: Sign up to volunteer at the tournament in an event your child is not participating in to help meet your school's volunteer requirements and support the smooth running of the competition.
- Chaperone Assistance: Consider offering to be the designated chaperone for your school to assist students with navigating to and from events.
- Impartial Volunteer Roles: While we greatly appreciate parent volunteers, those who volunteer will not be assigned as Event Supervisors or judges for their own child's events to maintain impartiality.

1.

- **Chaperones**

As a chaperone, you play a vital role in ensuring the smooth flow of the competition and the well-being of the students. Your responsibilities include:

- Student Escort: You are authorized to accompany students to and from their event locations, in addition to the coaches.
- Visible Identification: Always wear your chaperone badge so that it is clearly visible.
- Limited Access to Competition Areas: To maintain the integrity of the events, we ask that you do not remain in the competition areas after you have escorted students to or from their events.
- Communication Protocol: Kindly direct any questions or concerns regarding the events to the coaches and refrain from discussing them with Virginia Science Olympiad staff or Event Supervisors.

- **The Competition**
  - Science Olympiad events fall into two main categories: Study Events, which assess core knowledge through written tests, and Build Events (also known as hands-on events), where participants design and construct devices. The written tests
  - Study events have pre-set times for all teams from the same school. For instance, if an elementary school has three teams competing in Anatomy, all students from those teams will take the test simultaneously.
  - Coaches schedule Build Events through their VASO portal account.
  - Strict adherence to all safety rules is mandatory. Participants without the required safety equipment will not be allowed to participate in the event.
  - Participants may begin an event even if their partner hasn't arrived. A late partner can join the event in progress, but no additional time will be granted to the team.

- Once a test or event has begun, students are not permitted to leave and then re-enter.
- The competition day can be lengthy for students due to downtime between events. Coaches and families should plan activities accordingly.
- Event appeals must be submitted in writing, in person to the competition director or their representative (using official appeals forms), and with the assistance of the Head Coach or Co-Head Coach, within 30 minutes of the event's conclusion. Appeals will be addressed in the order they are received and resolved on the day of competition.
- Division A will not provide previous assessments, competition-day written tests, and the specific resources used by event writers.

- **Changes in Division A this year:**
  - Tournaments will shift to the spring, with two large tournaments planned for April 18th and April 25th.
  - Teams will now compete for only half a day, either in the morning or the afternoon on their assigned tournament date.
  - Each tournament day will feature four distinct sub-tournaments, identified by color (Red, Blue, Green, Purple), running concurrently.
  - Teams will exclusively compete against others within their designated color sub-tournament, and a complete set of medals will be awarded for each color division.
  - The competition schedule will be more condensed, potentially leading to a few more event conflicts, though self-scheduled build events will still occur during a team's half-day. Written tests for teams from the same school will continue to be administered simultaneously.
  - Schools will still be permitted to register up to three teams.
  - The process for assigning schools to specific competition dates and morning/afternoon sessions is still under consideration.

- **Competition Day Schedules:**
  - VASO will assign schools to either a morning or an afternoon competition.
  - Your team number will be a color and a two-digit number.
  - Team numbers assigned after registration completion. Do not assign students event times until you know your team number and the time of day you will compete.
  - The written testing schedule shows the times your team will participate for either the morning or afternoon sessions. These times will not change for your team.
  - The coach sets all building event times, in and around the student written test schedule.
  - All schools may have simultaneous scheduled event conflicts. Most often these arise if a student wants to participate in two events at the same time. We will not modify this event schedule to accommodate student choice.
  - All teams from the same school must participate at the same time in written events. No exceptions.

Blueprint Tournament (Morning) @ Oakton High School or Lake Braddock

VASO Setup 7:00-7:30

Morning Coach Check-In 7:30-8:10

30 Teams	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Written Events	**8:20-8:50**	**9:00-9:30**	**9:40-10:10**	**10:20-10:50**	**11:00-11:30**	**11:40-12:10**
Anatomy Extremophiles	Blueprint 1-10		Blueprint 11-20		Blueprint 21-30	
Fast Facts (3rd Grade Only) Data Investigations		Blueprint 1-10		Blueprint 11-20		Blueprint 21-30
Molecular Bonding Super Sleuths	Blueprint 11-20		Blueprint 21-30		Blueprint 1-10	
Shock Value Sounds of Music		Blueprint 11-20		Blueprint 21-30		Blueprint 1-10
Solar System Solar System (3rd Grade Only)	Blueprint 21-30		Blueprint 1-10		Blueprint 11-20	
Weather - Storms Oceans (3rd Grade Only)		Blueprint 21-30		Blueprint 1-10		Blueprint 11-20

Build Events	Session A 8:30-9:30	Session B 9:45-10:45	Session C 11:00-12:00
Astronaut Lander	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number
Bridge Building			
Bungee Egg Drop			
Propeller Car			
Chopper Challenge (3rd Grade Only)			
Gravity Vehicle			
Pentathlon			
Ping Pong Parachute			
Towers (3rd Grade Only)			
Sail Car			
Storm the Castle			
Build a Barge (3rd Grade Only)			
Wind Power			

STEM Expo continues until 1:30 PM

Awards Ceremony 2 PM - 3 PM

Infrared Tournament (Morning) @ Oakton High School or Lake Braddock

VASO Setup 7:00-7:30

Morning Coach Check-In 7:30-8:10

30 Teams	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6
Written Events	**8:20-8:50**	**9:00-9:30**	**9:40-10:10**	**10:20-10:50**	**11:00-11:30**	**11:40-12:10**
Anatomy Extremophiles		Infrared 1-10		Infrared 11-20		Infrared 21-30
Fast Facts (3rd Grade Only) Data Investigations	Infrared 1-10		Infrared 11-20		Infrared 21-30	
Molecular Bonding Super Sleuths		Infrared 11-20		Infrared 21-30		Infrared 1-10
Shock Value Sounds of Music	Infrared 11-20		Infrared 21-30		Infrared 1-10	
Solar System Solar System (3rd Grade Only)		Infrared 21-30		Infrared 1-10		Infrared 11-20
Weather - Storms Oceans (3rd Grade Only)	Infrared 21-30		Infrared 1-10		Infrared 11-20	

Build Events	Session A 8:30-9:30	Session B 9:45-10:45	Session C 11:00-12:00
Astronaut Lander	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number
Bridge Building			
Bungee Egg Drop			
Propeller Car			
Chopper Challenge (3rd Grade Only)			
Gravity Vehicle			
Pentathlon			
Ping Pong Parachute			
Towers (3rd Grade Only)			
Sail Car			
Storm the Castle			
Build a Barge (3rd Grade Only)			
Wind Power			

STEM Expo continues until 1:30 PM

Awards Ceremony 2 PM - 3 PM

Chlorophyll Tournament (Afternoon) @ Oakton High School or Lake Braddock

STEM Expo Starts at 11 AM

Afternoon Coach Check-In 12:20-1:00

30 Teams	Session 7	Session 8	Session 9	Session 10	Session 11	Session 12
Written Events	**1:00-1:30**	**1:40-2:10**	**2:20-2:50**	**3:00-3:30**	**3:40-4:10**	**4:20-4:50**
Anatomy Extremophiles	Chlorophyll 1-10		Chlorophyll 11-20		Chlorophyll 21-30	
Fast Facts (3rd Grade Only) Data Investigations		Chlorophyll 1-10		Chlorophyll 11-20		Chlorophyll 21-30
Molecular Bonding Super Sleuths	Chlorophyll 11-20		Chlorophyll 21-30		Chlorophyll 1-10	
Shock Value Sounds of Music		Chlorophyll 11-20		Chlorophyll 21-30		Chlorophyll 1-10
Solar System Solar System (3rd Grade Only)	Chlorophyll 21-30		Chlorophyll 1-10		Chlorophyll 11-20	
Weather - Storms Oceans (3rd Grade Only)		Chlorophyll 21-30		Chlorophyll 1-10		Chlorophyll 11-20

Build Events	**Session D** **1:10-2:10**	**Session E** **2:25-3:25**	**Session F** **3:40-4:40**
Astronaut Lander Bridge Building Bungee Egg Drop Propeller Car Chopper Challenge (3rd Grade Only) Gravity Vehicle Pentathlon Ping Pong Parachute Towers (3rd Grade Only) Sail Car Storm the Castle Build a Barge (3rd Grade Only) Wind Power	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number

STEM Expo continues until 6 PM

Awards Ceremony 6:30 PM – 7:30 PM

Dark Matter Tournament (Afternoon) @ Oakton High School or Lake Braddock

Expo Starts at 11 AM

Afternoon Coach Check-In 12:20-1:00

30 Teams	Session 7	Session 8	Session 9	Session 10	Session 11	Session 12
Written Events	**1:00-1:30**	**1:40-2:10**	**2:20-2:50**	**3:00-3:30**	**3:40-4:10**	**4:20-4:50**
Anatomy Extremophiles		**Dark Matter 1-10**		**Dark Matter 11-20**		**Dark Matter 21-30**
Fast Facts (3rd Grade Only) Data Investigations	Dark Matter 1-10		Dark Matter 11-20		Dark Matter 21-30	
Molecular Bonding Super Sleuths		**Dark Matter 11-20**		**Dark Matter 21-30**		**Dark Matter 1-10**
Shock Value Sounds of Music	Dark Matter 11-20		Dark Matter 21-30		Dark Matter 1-10	
Solar System Solar System (3rd Grade Only)		**Dark Matter 21-30**		**Dark Matter 1-10**		**Dark Matter 11-20**
Weather - Storms Oceans (3rd Grade Only)	Dark Matter 21-30		Dark Matter 1-10		Dark Matter 11-20	

Build Events	Session D 1:10-2:10	Session E 2:25-3:25	Session F 3:40-4:40
Astronaut Lander	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number	Coach Scheduled Testing Maximum 10 teams per Hour 1 Time Slot per Team Number
Bridge Building			
Bungee Egg Drop			
Propeller Car			
Chopper Challenge (3rd Grade Only)			
Gravity Vehicle			
Pentathlon			
Ping Pong Parachute			
Towers (3rd Grade Only)			
Sail Car			
Storm the Castle			
Build a Barge (3rd Grade Only)			
Wind Power			

STEM Expo continues until 6 PM

Awards Ceremony 6:30 PM – 7:30 PM

Practice Tips

- **Written Events:**
  - **Understand the Event:**
    - Check the Official Rules: Rules are VERY important! Pay close attention to the topics covered, any specific terms, and what materials (if any) you can bring.
    - Gather Information from Textbooks and Other Sources: Use a science textbook, library books, and reliable websites to learn about the topics in the rules.
  - **Study Strategies:**
    - Make a Study Schedule: Plan out what you'll study each day or week. Don't cram!
    - Take Notes: Don't just read! Write down the most important facts and concepts.
    - Use different methods:
      - Outlines
      - Mind maps
      - Flashcards
  - **Practice, Practice, Practice**:
    - Make your own questions: Try to write questions like the ones you might see on the test.
    - Study with your partner (it's a team event):
    - Quiz each other.
    - Divide up the topics and then teach them to each other.
  - **Organize a Binder/Folder:** Keep all your notes, practice tests, and other materials organized. This will help you find what you need quickly.
  - **Important Tips:**
    - Focus on the rules: The test will be based on the official rules, so make sure you understand them completely.
    - Don't be afraid to ask for help: Ask your coach, teachers, or other Science Olympiad students if you have questions.
    - Time Management: Practice answering questions under timed conditions, similar to the actual test.

Building Events

- Building events have written tests about the basic principles of the topic, structure or device the team needs to build for the competition.
- Division A does not allow teams to bring pre-built devices. Our objective is to ensure a team's performance is their own, and to have them learn and demonstrate skills they will need to compete successfully as they continue to Division B.
- Coaches can best prepare their teams for the competition by teaching underlying principles and skills, suggesting ideas, and advice on methods, tools, or materials to accomplish the task. Students should practice their events using different materials (suggested materials are included in each event description) and be familiar with the concepts so that they can apply them regardless of the materials provided at the competition.
- Encourage the students to gather information and ideas from library books, teachers, parents, engineers, scientists, and other available resources. The intent is not to reinvent the wheel nor to be given a finished design, but to integrate and build on information gathered. Example: A book on crossbows may contain information on how to make the trigger mechanism for a catapult.
- The students retain control of the process of preparing for a Science Olympiad event. This means that they should have the last word on how to practice for their events.
- An important part of any design process is brainstorming. We encourage the entire team to participate in the discovery process, not just the two or three that will be involved at the competition. An adult

may function as a mentor for the group and ask questions or offer ideas. Do not forget the students should make the final choices.

- Some events require the collection and interpretation of data. Students will be most successful if they have had the opportunity to do this at their practice sessions.
- Keep in mind that the purpose of Science Olympiad is to encourage the exploration and pursuit of science while having fun in the process.

Awards and Scoring

- In Division A, the emphasis is on partner achievement; therefore, no team awards are given. Event results are not used to generate a cumulative team score. This approach allows students and teams the flexibility to experiment with various events without the strategic requirement of having participants in all events for team scoring purposes.
- At the end of each competition, Division A awards medals to students that place within the top 10 for each event.
- Scoring events takes time and scoring varies by event and event rules include explanations of scoring. We may delay the awards ceremony to allow the Event Supervisors time to complete their scoring.
- The Division A awards ceremony will begin with a Parade of Teams. Each participating school is invited to display a team banner and march to the designated awards area, showcasing their spirit and enthusiasm. The parade will commence approximately 30 minutes before the announced awards time; please be aware that the precise start is subject to the completion of final event scoring.
- The top ten performing teams in each event earn medals for their efforts.

Division A Science Olympiad Calculator Classes

These are the acceptable calculators for all Division A events required or optional.	
Class I - Stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators. These are the most basic type of calculators. They are limited to the four basic mathematic functions and square roots. They are often cheap, costing as low as a dollar online.	
Class II - Stand-alone non-programmable, non-graphing calculators - They do not have the "EXE" button, "Prog" button, or a "file" button. Examples: CASIO FX-260, Sharp EL-501, TI-30X, TI-34, Texas Instructions BA II Plus	

Safety Information

Indirect Vent Googles or Safety glasses are a mandatory safety requirement for some events.

Category C: Indirect Vent Goggles	Category B: Safety glasses
	

EYE PROTECTION

Purpose: This policy provides details regarding EYE PROTECTION in those events where an Event Rule requires Eye Protection. The objective is to choose the type of protection specific to the task.

Competitor/Coach Responsibilities: Competitors are responsible for providing their own protective eyewear. Science Olympiad is unable to determine the degree of hazard presented by equipment, materials and devices brought by the teams. Coaches must ensure the eye protection competitors bring is adequate for the hazard. All protective eyewear must bear the manufacturer's mark Z87. Teams without adequate eye protection must be given a chance to obtain eye protection if their assigned time permits.

Teams will not be allowed to compete without adequate eye protection. This is non-negotiable.

Corresponding Standards: Protective eyewear used in Science Olympiad must be manufactured to meet the American National Standards Institute (ANSI) standard applicable at its time of manufacture. The current standard is ANSI/ISEA Z87.1-2015. Competitors, coaches and event supervisors are not required to acquire a copy of the standard. The information in this document is sufficient to comply with current standards. Water is not a hazardous liquid, and its use does not require protective eyewear unless it is under pressure or substances that create a hazard are added.

Examples of Non-Compliant Eyewear:

- Face shields/visors are secondary protective devices and are not approved in lieu of the primary eye protection devices below regardless of the type of vents they have.
- 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.

Compliant Eyewear Categories: If an event requires eye protection, the rules will identify one of these three categories - as simple as ABC:

CATEGORY A

- Description: Non-impact protection. They provide basic particle protection only
- Corresponding ANSI designation/required marking: Z87
- Examples: Safety glasses; Safety spectacles with side shields; and Particle protection goggles (these seal tightly to the face completely around the eyes and have direct vents around the sides, consisting of several small holes or a screen that can be seen through in a straight line)

CATEGORY B

- Description: Impact protection. They provide protection from a high inertia particle hazard (high mass or velocity)
- Corresponding ANSI designation/required marking: Z87+
- Example: High impact safety goggles

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)
- Example: Indirect vent chemical/splash protection goggles

Notes:

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

3rd Graders Only - Build-a-Barge (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build a barge to hold the greatest amount of cargo, measured in grams, before sinking. This event has a short knowledge assessment. **This event has a building component and a written test on Archimedes principle, displacement, buoyancy and flotation.**

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

Spirit of the Problem:

- ➢ **The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).**
- ➢ **It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.**

Safety Teams Must Bring:

- **ANSI Z87 D3 Splash/Droplet standards; goggles must be worn during all event testing.**
- **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.**

Category C: Indirect Vent Goggles

Eyeglasses and Safety Glasses are not safety rated for this event!

Teams Must Bring:

- **Indirect-vent Safety Goggles**
- Writing Utensils
- Scissors
- **Optionally-** Teams may also bring rulers, protractors, tape-measures and a Class 1 or Class 2 calculator.

Materials provided at event:

- Each team will receive a set of materials to build a barge:
  - 1 ≈ 30cm square piece of aluminum foil
  - 2 ≈ 10.8 x 29 cm small plastic sheets
  - 1 ≈ 10 x 10 cm cardboard, 50 cm masking tape, and 10 - 20 cm paper straws.
- Cargo ≈ 2.5 gram coins
- A container at least 30 cm long by 30cm wide and filled to a depth of at least 20 cm with water.
- Scale to weigh the cargo in grams.
- A device to measure the size of the student device.

The Competition:

1. **Building Phase**
   a. Teams will have 15 minutes to complete a barge meeting the following criteria:

b. The barge may have only one, continuous area for cargo (i.e., no separate cargo compartments), and must be open at the top for loading.
c. The completed barge must fit completely within a box measuring 15cm x 15cm x 2.5cm.
d. **Teams will write down their estimate for the amount of cargo (in grams) that their barge will hold during their written assessment.**
e. Using the materials provided, the barge may include components that help it stay afloat, remain stable or otherwise improve its cargo- carrying capacity as long as they fit within the measuring box.
f. Teams do not need to use all of the materials.

2. Written Assessment

a. The written assessment will contain questions on Archimedes principle, displacement, buoyancy, and flotation
b. This assessment will take place at the same time as the team is building their device
c. **Teams will write down their estimate for the amount of cargo (in grams) that their barge will hold during their written assessment**

3. Device Testing

a. When called, teams will have 2 minutes to place their barge in a test container and load it with cargo
b. Cargo is loaded one piece at a time until the barge sinks, or is holding all the available cargo
c. Cargo mass held will be measured, in grams, before the barge sink. The mass of the last piece of cargo added, that causes the barge to sink, will not be included in the total
d. A barge is considered to have "sunk" when the top of the cargo area is completely below the water surface. It is not necessary for the barge to settle to the bottom of the container. If a barge takes on water but the top of the cargo area remains above the water surface, the team may continue to add cargo, however the mass of any water in the barge will not count toward the total mass held
e. Teams may not attempt to remove water that enters their barge during testing
f. The cargo will be dried before weighing

4. Event Supervisor Records

a. Whether the team barge meets the building requirement
b. Team estimate of mass
c. The time from placement of the team device in the water container to the time it sinks
d. The total mass held by the device
e. The team assessment score

5. Scoring:

1. Acronyms
    a. Competition Mass Score (CMS) = the heaviest mass for all teams
    b. Competition Assessment Score (CAS) = the highest assessment score for all teams
    c. Final Score (FS)
    d. Team Mass Score (TMS)
    e. Team Assessment Score (TAS)
2. Final Score (FS) = Assessment Score (TAS) + Mass Score (TMS). The maximum score is 100 points.
    a. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
    b. Mass Score = (TMS ÷ CMS) x 50 points; rounded to the 100th place value
3. Example
    a. (CAS) = 22. The team scores 17 on the assessment. (TAS) for the team= (17 ÷ 22) x 50 = 36.64

points
b. (CMS) = 345 grams. The team's mass held is 115. (TMS) for the team= (115 ÷ 345) x 50 = 16.67 points
c. (FS) = 36.64 + 16.67 = 53.31 points

6. **Tiers**
   a. Tier 1 - Barge meets all building criteria, and the team follows the spirit of the problem
   b. Tier 2 - Barge has a building error or does not follow the spirit of the problem. Teams in Tier 2 with building errors will test their barge but will be ranked below all teams in Tier 1
   c. Teams breaking the spirit of the problem will not test

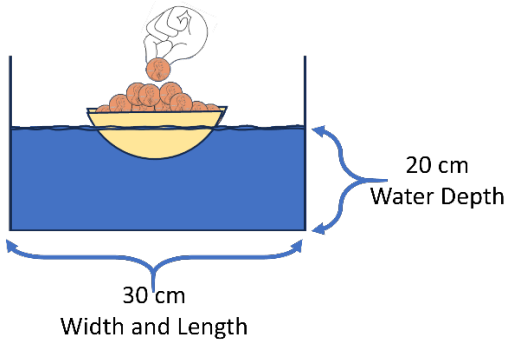
7. **Tiebreakers:**
   a. The team with the closest estimate to the mass their barge holds wins the tiebreaker
   b. Longest time afloat
   c. Assessment score
   d. Questions selected by the test writer as tiebreakers

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
   i. Archimedes Principle
   ii. Displacement
   iii. Buoyancy

Competition Diagram:

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



Study Guide: Archimedes' Principle, Displacement, Buoyancy, and Flotation

Key Concepts

- **Archimedes' Principle:**
  - An object immersed in a fluid experiences an upward force (buoyant force) equal to the weight of the fluid displaced by the object.
  - Buoyant force = Weight of fluid displaced
- **Displacement:**

    - The amount of fluid that is pushed aside or moved out of the way by an object when it is placed in the fluid.
    - Measured in units of volume (e.g., milliliters, liters, cubic centimeters).
- **Buoyancy:**
    - The tendency of an object to float in a fluid.
    - Determined by the relationship between the object's weight and the buoyant force acting on it.
- **Flotation:**
    - The ability of an object to float on the surface of a fluid.
    - Occurs when the buoyant force acting on the object is equal to or greater than the object's weight.

Important Terms

- **Density:** The mass of a substance per unit volume.
- **Weight:** The force of gravity acting on an object.
- **Fluid:** Any substance that can flow, such as liquids and gases.

Practice Problems

1. **A block of wood has a volume of 100 cubic centimeters and a mass of 80 grams. Will it float or sink in water? Why?**
    - **Hint:** Calculate the density of the wood and compare it to the density of water (1 g/cm^3).
2. **A rock displaces 50 milliliters of water when placed in a graduated cylinder. What is the volume of the rock?**
3. **Explain how a hot air balloon works in terms of buoyancy and density.**
4. **Why does a ship of steel float, but a steel ball sinks?**

Review Questions

- What is Archimedes' Principle?
- How does displacement relate to buoyancy?
- What factors determine whether an object will float or sink in a fluid?
- Explain the concept of density and its role in flotation.

Additional Resources

- **Online simulations:** Many websites offer interactive simulations that demonstrate Archimedes' Principle and buoyancy.
- **Videos:** Search for educational videos on YouTube or other platforms that explain these concepts visually.

Remember:

- Practice regularly to reinforce your understanding.
- Ask your teacher or classmates for help if you are struggling with any of these concepts.
- Good luck on your test!

3rd Graders Only - Chopper Challenge (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build and test one chopper, a rotary flying device, and take an assessment on the history and origins and history 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

Team Needs to Bring:

- Writing utensils
- A ruler/straight edge
- Scissors
- Team chart showing testing results for dropping a chopper, 6 times or more, from various heights, with and without weights (Minimum requirement-18 drops: 6 drops-3 different heights, with and without weight)

Materials Provided at Event:

- 0.5g aluminum split shot weight
- one sheet of 8 ½ x 11-inch 60–90-pound card stock
- one large paper clip

Safety Requirements: None

The Competition:

1. **Building Phase:**
    a. The chopper will be made using the single sheet of paper and the large paper clip. The team does not need to use all of the paper they are given but must use the paper clip.
    b. The chopper must have at least two rotor blades.
    c. The paper clip must stay in its original shape and may not be bent into another other shape.
    d. Rotation of the chopper (clockwise, counterclockwise, horizontal, or vertical) is a team choice.
    e. The drop distance will be announced during the building phase.
    f. Contestants may test their devices in the building area without the weight attached but will not be allowed to test from the official drop location.
    g. Teams must write their team designator on their chopper.
    h. When the team has finished construction of their chopper the Event Supervisor will attach the weight anywhere on the chopper that the team requests.

2. **Written Assessment:**
    a. The written assessment will contain 15-20 questions on the history and origins and history of rotary flight
    b. The assessment will take place at the same time as the team is building their device
    c. **During the written assessment teams will write down their estimate for the amount of time their chopper will take to land**

3. **Flight Phase:**
    a. Each team will have two drops of their chopper with the 0.5g weight.

b. Maximum drop height will be the top of a 2-story school stairway. Minimum drop will be from the top of an elementary school bleachers.
c. Participants will wait for the Event Supervisor to give the okay to drop their chopper. They will then announce their intention to drop their chopper by saying "3, 2, 1, Drop."
d. Time will start when judges see the chopper leave the hand of the student.
e. Two timers will the time required for a team's chopper to reach the ground/floor to the nearest 1/100.
    i. Time will continue if the chopper bounces off an object but will stop when the chopper gets stuck or stops.
f. The chopper must rotate more than five times before stopping for the flight to be scored.
    i. Students may not artificially spin the chopper. It must be a natural spin
g. The Event Supervisor will add the times for each flight and divide by two to get the team flight time.

4. Event Supervisor Records

a. Assessment scores
b. Flight times
c. Estimated flight time

5. Scoring:

a. Acronyms
    i. Competition Flight Score (CFS) = the longest flight time for all teams
    ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
    iii. Final Score (FS)
    iv. Team Time Score (TTS)
    v. Team Assessment Score (TAS)
b. Final Score (FS) = Assessment Score (TAS) + Time Score (TTS). The maximum score is 100 points.
    i. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
    ii. Time Score = (TTS ÷ CFS) x 50 points; rounded to the 100th place value
c. Example
    i. (CAS) = 13. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 13) x 50 = 34.61 points
    ii. (CFS) = 3.56 seconds. The team's flight time is 1.45. (TTS) for the team= (1.45 ÷ 3.56) x 50 = 20.37 points
    iii. (FS) = 34.61 + 20.37 = 50.98 points

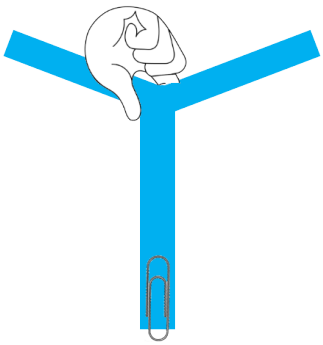
6. **Tiebreakers:**

a. Completeness of the team chart showing testing. Teams showing more testing details will be ranked above others. (Minimum requirement: 6 drops-3 heights, with and without weight)
b. The closest estimate to the actual flight time to the nearest 1/100 of a second.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
    i. Student Project: Make a Paper Mars Helicopter | NASA/JPL Edu
    ii. Science Activity: Make a Mini-Helicopter From Paper! | Exploratorium
    iii. NASA – Maple Seed Helicopter

Competition Diagram



Rotary Flight: A Study Guide

I. Introduction

- **What is Rotary Flight?**
  - Define rotary flight and how it differs from fixed-wing aircraft.
  - Briefly discuss the concept of lift and how it's achieved in rotary-wing aircraft.
- **Key Concepts:**
  - **Rotor:** The spinning blades that provide lift.
  - **Vertical Takeoff and Landing (VTOL):** The ability to take off and land without a runway.
  - **Hovering:** The ability to remain stationary in the air.

II. Early Concepts and Experiments

- **Ancient Ideas:**
  - Mention early observations of birds and insects.
  - Discuss the concept of the "flying top" and its potential influence.
- **Da Vinci's Designs:**
  - Explore Leonardo da Vinci's sketches of flying machines, including his "aerial screw."
- **Early Models and Experiments:**
  - Discuss early attempts at building flying machines with rotating blades.
  - Highlight the challenges faced by early inventors.

III. Key Figures and Breakthroughs

- **Igor Sikorsky:**
  - Discuss his contributions to helicopter development.
  - Mention his successful flights of the VS-300 helicopter in 1939.
- **Other Pioneers:**
  - Briefly mention other important figures like Juan de la Cierva (autogyro) and Arthur M. Young.

IV. Types of Rotary-Wing Aircraft

- **Helicopters:**
  - Explain the basic principles of helicopter flight.
  - Discuss different types of helicopter rotors (single-rotor, tandem-rotor, coaxial-rotor).
- **Autogyros:**
  - Describe how autogyros differ from helicopters.
  - Explain the role of the rotor in an autogyro.
- **Tiltrotors:**
  - Discuss the unique features of tiltrotor aircraft (e.g., V-22 Osprey).

V. Modern Applications of Rotary Flight

  - Explore the use of helicopters in emergency medical services, law enforcement, search and rescue, and civilian transportation.

- Mention the role of helicopters in tourism and recreation.

VI. Future of Rotary Flight

- **Advanced Technologies:**
  - Discuss potential advancements in rotorcraft technology, such as electric propulsion and autonomous flight.
  - Explore the possibility of personal air vehicles and urban air mobility.

Study Tips

- **Use Visual Aids:**
  - Look at pictures and videos of different types of rotary-wing aircraft.
  - Create diagrams to illustrate key concepts.
- **Practice Explaining Concepts:**
  - Try to explain the principles of rotary flight to someone else.
- **Review Key Dates and Events:**
  - Create a timeline of important events in the history of rotary flight.

Remember to study diligently and good luck on your test!

3rd Graders Only - Fast Facts (On the team schedule - 30 minutes)

Description: Teams will complete three answer grids in three rounds on the topics of Scientists, Ecology, Rocks & Minerals, Oceans, and Weather. This event will use scientists and vocabulary found in the science curriculum from the Virginia Department of Education in grades Kindergarten through 8th grade.

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 need to bring: Pencils

Safety Requirements: None

The Competition:

Teams may not bring any information resources or other material into the event.

a. This competition will consist of 3 rounds. Each round will begin with the supervisor giving each team the same scoresheet that contains a grid which has 4 different science categories listed along the horizontal axis and 4 different letters listed along the vertical axis.
b. The test writer will determine the categories to be used in each round, ensuring that there is at least one valid answer for each category/letter combination. Categories must not be repeated within a grid or among the three grids used in competition. No letter can be repeated more than twice in the three grids.
c. Teams will have 5 minutes to complete each round. Teams will write a term, corresponding to the given category and beginning with the given letter, in each of the 16 boxes of the grid.
d. At the end of 5 minutes the event supervisor will stop the round. For each round all students should start and stop writing at the same time as directed by the event supervisor. Students beginning before or after the supervisor starts/stops the round will have their scoresheet not scored for that round.
e. A scoresheet without student names and school will not be scored resulting in that scoresheet not being added to the final score.
f. At the end of each round the supervisor will pick up all scoresheets. Then a new set of scoresheets will be distributed to students. This will be repeated for each of the 3 rounds.
g. Names of the categories must not be used in the answer.
h. If a correct response has more than one word, the 1st letter of the first word will be used (e.g., “D” is the 1st letter of “Doppler Effect”); Exceptions: The 1st letter of a word following the articles “the” or “a/an” will be considered the 1st letter of the term (e.g., “G” is the 1st letter for the term “The Grand Canyon”).
i. Students may not write two or more different forms of a response within a category to get credit for two or more different answers (e.g., Category - “Human Organs”, Letters - “I”, “L” and “S”, and the student writes “small intestine”, “large intestine” and “intestine”. The student would only get credit for “small intestine” and “large intestine” because these terms are the most precise of the three responses).
j. If the category asks for the name of a person, both the given (first) and surname (last) of a person must be written. The first letter of the surname must match the required letter (e.g., “C” – Marie Curie)
k. Incorrect spellings of the word will be allowed if the Event Supervisor is able to determine the intended term. However, the first letter of the response must be correct (e.g., “Krust” would not be allowed for “crust”).
l. All words must be found in an English based science dictionary. Abbreviations are not allowed.

Scoring:

1. The number of points earned depends upon the number of correct terms listed in a row and in a column. Points will be awarded as follows:
    a. One correct term in a row = 1 pt. One correct term in a column = 1 pt.
    b. Two correct terms in a row = 4 pts. Two correct terms in a column = 4 pts.
    c. Three correct terms in a row = 9 pts. Three correct terms in a column = 9 pts.
    d. Four correct terms in a row = 16 pts. Four correct terms in a column = 16 pts.
2. The round score will be determined by adding the scores from each of the rows and columns. Final score will be determined by adding all the round scores.
3. Highest total score wins.
4. Tiebreakers will be determined by the following sequence:
    a. Highest individual round score
    b. Second highest individual round score
    c. Most columns/rows with 4 correct
    d. Most columns/rows with 3 correct
    e. Most columns/rows with 2 correct
    f. Most columns/ rows with 1 correct

Sample score sheet:

Round 1	**Weather**	**Oceans**	**Ecology**	**Rocks**	**Row Scores**
C	Cloud		Climate		2
L	Lightning	Layers	Litter	Lode	4
M	Meteorology				1
T	Temperature	Tide			2
Column Scores	**4**	**2**	**2**	**1**	**CS=9 + RS=9**
					Total Score 18

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
    i. Science Standards of Learning | Virginia Department of Education

Study outline covering Scientists, Ecology, Rocks & Minerals, Oceans, and Weather, incorporating Virginia DOE science curriculum vocabulary and concepts for grades K-8:

Overall Theme: Exploring Our World Through Science

I. Scientists and the Scientific Process (Grades K-8)

- A. What is a Scientist? (K-2)

    - People who ask questions about the world.
    - People who observe and explore.
    - Examples of scientists and what they study (e.g., animal scientist, plant scientist, weather scientist).
    - Vocabulary: observe, explore, question, discover.
- B. How Scientists Work (Grades 3-5)
    - Asking questions and forming hypotheses (simple predictions).
    - Planning and conducting simple investigations/experiments.
    - Making observations and collecting data (using simple tools like rulers, thermometers, hand lenses).
    - Recording and sharing data (simple charts and graphs).
    - Drawing conclusions based on evidence.
    - Vocabulary: hypothesis, investigate, experiment, data, evidence, conclusion, record, measure.
- C. The Scientific Method (Grades 6-8)
    - Identifying a problem or question.
    - Forming a testable hypothesis.
    - Designing and conducting controlled experiments.
    - Identifying variables (independent, dependent, controlled).
    - Collecting, organizing, and analyzing data.
    - Drawing conclusions and communicating results.
    - Understanding that scientific knowledge is subject to change with new evidence.
    - Vocabulary: scientific method, variable, independent variable, dependent variable, controlled variable, analyze, interpret, theory, law.
- D. Famous Scientists and Their Contributions (Grades K-8 - age-appropriate examples)
    - Highlighting scientists relevant to the other topics (e.g., marine biologists for oceans, meteorologists for weather, geologists for rocks and minerals, ecologists for ecology).
    - Focus on their curiosity and contributions to our understanding.
    - Examples: Jane Goodall, Sylvia Earle, George Washington Carver, Marie Curie (simplified for younger grades).

II. Ecology: Living Things and Their Interactions (Grades K-8)

- A. Living and Nonliving Things (K-2)
    - Identifying characteristics of living things (need for food, water, air, growth, reproduction).
    - Distinguishing between living and nonliving things in different environments.
    - Vocabulary: living, nonliving, environment, grow, need.
- B. Habitats and Communities (Grades 3-5)
    - Defining habitat as a place where an organism lives and finds what it needs.
    - Exploring different types of habitats (forests, ponds, oceans, deserts).
    - Understanding that a community includes all the living things in a habitat.
    - Vocabulary: habitat, community, organism, shelter, resources.
- C. Food Chains and Food Webs (Grades 3-5)
    - Understanding the flow of energy in an ecosystem.
    - Identifying producers (plants), consumers (herbivores, carnivores, omnivores), and decomposers.
    - Illustrating simple food chains and recognizing that food webs show more complex interactions.
    - Vocabulary: food chain, food web, producer, consumer, herbivore, carnivore, omnivore, decomposer, energy.
- D. Interdependence and Ecosystems (Grades 6-8)
    - Exploring the relationships between living and nonliving components of an ecosystem.
    - Understanding concepts like competition, predation, symbiosis (mutualism, commensalism, parasitism).
    - Investigating how changes in an ecosystem can affect populations (e.g., introduction of a new species, habitat destruction).

    - Vocabulary: ecosystem, interdependence, population, competition, predation, symbiosis, mutualism, commensalism, parasitism, biodiversity.
- E. Adaptations (Grades 3-8)
    - How living things have special features (adaptations) that help them survive in their environment.
    - Examples of physical and behavioral adaptations in different organisms.
    - Vocabulary: adaptation, physical adaptation, behavioral adaptation, survival.

III. Rocks and Minerals (Grades K-8)

- A. What are Rocks? (K-2)
    - Observing and describing different types of rocks (size, shape, color, texture).
    - Understanding that rocks are made of different materials.
    - Vocabulary: rock, size, shape, color, texture.
- B. What are Minerals? (Grades 3-5)
    - Understanding that rocks are made of minerals.
    - Identifying basic properties of minerals (color, luster, hardness, streak).
    - Examples of common minerals.
    - Vocabulary: mineral, property, luster, hardness, streak.
- C. Types of Rocks (Grades 4-6)
    - Introducing the three main types of rocks: igneous, sedimentary, and metamorphic.
    - Understanding how each type is formed (cooling magma/lava, compaction and cementation of sediments, heat and pressure).
    - Examples of each rock type.
    - Vocabulary: igneous rock, sedimentary rock, metamorphic rock, magma, lava, sediment, compaction, cementation, heat, pressure.
- D. The Rock Cycle (Grades 6-8)
    - Understanding that rocks change over time in a continuous process called the rock cycle.
    - Illustrating the different pathways of the rock cycle.
    - Vocabulary: rock cycle, weathering, erosion, deposition.
- E. Uses of Rocks and Minerals (Grades K-8)
    - Exploring how rocks and minerals are used in everyday life (building materials, tools, jewelry, etc.).

IV. Oceans (Grades K-8)

- A. What are Oceans? (K-2)
    - Understanding that oceans are large bodies of saltwater.
    - Identifying major oceans on a map or globe.
    - Vocabulary: ocean, saltwater, map, globe.
- B. Ocean Habitats and Life (Grades 3-5)
    - Exploring different ocean zones (surface, deep ocean, coral reefs, etc.).
    - Identifying diverse plant and animal life in the ocean.
    - Understanding basic ocean food chains.
    - Vocabulary: ocean zone, marine, coral reef, plankton, food web.
- C. Ocean Currents and Tides (Grades 4-6)
    - Understanding that ocean water moves in currents.
    - Explaining the basic causes of tides (gravitational pull of the moon and sun).
    - Vocabulary: current, tide, gravity, moon, sun.
- D. Importance of Oceans (Grades 6-8)
    - Understanding the ocean's role in regulating climate.
    - Exploring ocean resources (food, minerals).
    - Discussing human impact on oceans (pollution, overfishing).
    - Vocabulary: climate, pollution, conservation, resource.
- E. Ocean Exploration and Scientists (Grades K-8)
    - Highlighting the work of marine biologists and oceanographers.

- Exploring tools and technologies used to study the ocean (submarines, remotely operated vehicles).

V. Weather (Grades K-8)

- A. What is Weather? (K-2)
  - Observing and describing different types of weather (sunny, cloudy, rainy, snowy, windy).
  - Identifying basic weather tools (thermometer, rain gauge, wind vane).
  - Vocabulary: weather, sunny, cloudy, rainy, snowy, windy, thermometer, rain gauge, wind vane.
- B. Measuring Weather (Grades 3-5)
  - Using simple tools to measure temperature, precipitation, wind speed, and wind direction.
  - Keeping simple weather records.
  - Vocabulary: temperature, precipitation, wind speed, wind direction.
- C. Clouds and Precipitation (Grades 3-5)
  - Identifying different types of clouds (cumulus, stratus, cirrus).
  - Understanding the different forms of precipitation (rain, snow, sleet, hail).
  - Vocabulary: cloud, cumulus, stratus, cirrus, precipitation, rain, snow, sleet, hail.
- D. Understanding Weather Patterns (Grades 4-6)
  - Exploring how air temperature and pressure affect weather.
  - Understanding the concept of fronts (cold and warm).
  - Identifying basic weather symbols on a weather map.
  - Vocabulary: air pressure, front, weather map.
- E. Severe Weather (Grades 6-8)
  - Learning about different types of severe weather (thunderstorms, hurricanes, tornadoes).
  - Understanding the conditions that lead to severe weather.
  - Discussing safety precautions during severe weather.
  - Vocabulary: thunderstorm, hurricane, tornado, meteorologist, warning, safety.
- F. The Water Cycle (Grades 4-8)
  - Understanding the continuous movement of water on, above, and below the surface of the Earth (evaporation, condensation, precipitation, collection).
  - Vocabulary: water cycle, evaporation, condensation, collection.

3rd Graders Only - Oceans (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment about ocean zones, species adaptations for the zones, and the daily migration of organisms for survival.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams Must Bring:

- Pen/Pencil

Competition:

The written assessment will contain 25-50 questions on ocean zones and how different species adapt for survival. It will only cover general adaptations and daily migrations. It will not be species specific, but teams must know some representative species for each zone.

Scoring:

a. Points will be awarded for each correct response
b. Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or the Event Supervisor

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
    i. National Oceanic and Atmospheric Administration (NOAA): NOAA Ocean Exploration - Excellent for deep-sea exploration and zone information.
    ii. Monterey Bay Aquarium Research Institute (MBARI): MBARI - Deep-sea research and videos.
    iii. Smithsonian Ocean: Smithsonian Ocean - Educational resources on marine life and ocean zones.
    iv. Khan Academy: Search "Ocean Zones" on Khan Academy for educational videos.

Ocean Zones, Adaptations, and Migration Study Outline

1. Ocean Zones

a. Introduction: The ocean is divided into zones based on depth, light, and pressure. Understanding these zones is key to understanding marine life.
    i. Major Zones:
        1. Sunlight Zone (Epipelagic Zone):
            a. Closest to the surface.
            b. Most sunlight, enabling photosynthesis.
            c. Home to a wide variety of marine life.
        2. Twilight Zone (Mesopelagic Zone):
            a. Dimly lit, some sunlight penetrates.
            b. Organisms adapted to low light.
        3. Midnight Zone (Bathypelagic Zone):
            a. No sunlight, completely dark.
            b. High pressure, cold temperatures.
            c. Organisms often have bioluminescence.
        4. Abyssal Zone (Abyssopelagic Zone):
            a. Very deep, extremely high pressure.
            b. Very cold, little life.
            c. Organisms rely on "marine snow" (falling organic matter).
        5. Trenches (Hadal Zone):
            a. Deepest ocean areas, found in trenches.
            b. Extreme pressure, cold.
            c. Specialized organisms adapted to these conditions.
        6. Intertidal Zone:
            a. Where the ocean meets the land.
            b. Organisms must adapt to changing tides and exposure.

2. Adaptations
    a. Sunlight Zone Adaptations:
        i. Camouflage (blending in).
        ii. Speed for hunting or escaping predators.
        iii. Photosynthesis in algae and phytoplankton.
    b. Twilight Zone Adaptations:
        i. Large eyes for low-light vision.
        ii. Bioluminescence (producing light).
        iii. Countershading (dark on top, light on bottom).
    c. Midnight Zone Adaptations:
        i. Bioluminescence for communication and hunting.
        ii. Large mouths and sharp teeth.
        iii. Slow metabolism to conserve energy.
        iv. Reduced skeletal structure.
    d. Abyssal and Trenches Adaptations:
        i. Extreme pressure tolerance.
        ii. Chemosynthesis (producing energy from chemicals).
        iii. Flexible bodies.
    e. Intertidal Zone Adaptations:
        i. Ability to withstand exposure to air.
        ii. Strong attachments to rocks.
        iii. Burrowing to avoid predators.
3. Daily Migration (Vertical Migration)
    a. Concept: Many marine organisms move between zones daily. Typically, they rise to the surface at

night to feed and descend during the day to avoid predators.

i. Reasons for Migration:
    1. Feeding: Following plankton and other food sources.
    2. Predator avoidance: Staying in dark zones during the day.
    3. Light levels: Responding to changes in sunlight.
    4. Examples:
        a. Zooplankton migrating to the surface at night.
        b. Squid and fish following zooplankton.

4. Vocabulary
    a. Epipelagic Zone: The sunlight zone.
    b. Mesopelagic Zone: The twilight zone.
    c. Bathypelagic Zone: The midnight zone.
    d. Abyssopelagic Zone: The abyssal zone.
    e. Hadal Zone: The trench zone.
    f. Intertidal Zone: The area between high and low tide.
    g. Bioluminescence: The production of light by living organisms.
    h. Camouflage: Blending in with the environment.
    i. Countershading: Dark on top, light on bottom.
    j. Chemosynthesis: Producing energy from chemicals.
    k. Vertical Migration: Daily movement between ocean zones.
    l. Plankton: Microscopic organisms that drift in water.
    m. Marine Snow: Organic matter that falls from upper layers of the ocean.
5. Study Tips:
    a. Use visual aids (pictures, videos).
    b. Draw diagrams of the ocean zones.
    c. Create flashcards for vocabulary terms.
    d. Watch documentaries about ocean life.
    e. Make a chart comparing adaptations in different zones.
    f. Create a diagram showing the daily migration of creatures.

3rd Graders Only - Solar System (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on the eight planets and their main identifying features, their moons.

Participants per assigned Team Number:

- 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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils

Safety Requirements: None

The Competition:
This written assessment will contain 25-50 questions on the eight planets and their main identifying features, their moons. The assessment may include topic questions based on the following planet classifications and characteristics information:

- Planet relative distance from the sun
- Planet relative size
- Planet temperature
- Planet composition and density
- Planet length of day
- Planet length of year
- Planet number of and composition of moons
- Planet atmospheres
- Understand the astronomical definitions for the terms: zenith, horizon, celestial meridian, celestial poles, celestial equator, and ecliptic as they help locate the planets in the night sky on the day of the competition.

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer prior to the competition.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

i. NASA: About the Planets
ii. The Nine Planets

1. Astronomy Study Guide: Planets and the Night Sky

I. The Eight Planets: Key Features

A. Terrestrial (Rocky) Planets

1. Mercury:
   - Closest to the Sun.
   - Smallest planet.
   - Extreme temperature variations (day very hot, night very cold).
   - Thin atmosphere (exosphere).
   - Heavily cratered surface.
   - Length of day: About 59 Earth days.
   - Length of year: About 88 Earth days.
   - No moons.
2. Venus:
   - "Earth's sister planet" (similar size).
   - Hottest planet (thick CO2 atmosphere creates a greenhouse effect).
   - Rotates slowly in the opposite direction (retrograde rotation).
   - Length of day: About 243 Earth days.
   - Length of year: About 225 Earth days.
   - No moons.
3. Earth:
   - Only known planet to support life.
   - Liquid water on the surface.
   - Nitrogen and oxygen-rich atmosphere.
   - Length of day: About 24 hours.
   - Length of year: 365.25 days.
   - One moon (Luna).
4. Mars:
   - "Red Planet" (iron oxide in the soil).
   - Thin atmosphere.
   - Polar ice caps.
   - Evidence of past liquid water.
   - Length of day: Slightly longer than Earth's.
   - Length of year: About 687 Earth days.
   - Two moons (Phobos, Deimos).

B. Gas Giant Planets

1. Jupiter:
   - Largest planet.
   - Great Red Spot (giant storm).

- Strong magnetic field.
- Many moons (including Galilean moons: Io, Europa, Ganymede, Callisto).
- Length of day: About 10 Earth hours.
- Length of year: About 12 Earth years.
- Composition: Mostly hydrogen and helium.

2. Saturn:
   - Prominent ring system (ice and rock).
   - Titan (largest moon, with a thick atmosphere).
   - Length of day: About 10.7 Earth hours.
   - Length of year: About 29 Earth years.
   - Composition: Mostly hydrogen and helium.
3. Uranus:
   - Rotates on its side.
   - Blue-green color (methane in the atmosphere).
   - Ring system.
   - Length of day: About 17 Earth hours.
   - Length of year: About 84 Earth years.
   - Composition: Ices, hydrogen, and helium.
4. Neptune:
   - Blue color (methane in the atmosphere).
   - Strong winds.
   - Triton (largest moon, with retrograde orbit).
   - Length of day: About 16 Earth hours.
   - Length of year: About 165 Earth years.
   - Composition: Ices, hydrogen, and helium.

II. Astronomical Terms

- Zenith: The point directly overhead.
- Horizon: The line where the sky and Earth appear to meet.
- Celestial Meridian: An imaginary line passing from the north celestial pole through the zenith to the south celestial pole.
- Celestial Poles: The points in the sky directly above Earth's north and south poles.
- Celestial Equator: An imaginary circle in the sky directly above Earth's equator.
- Ecliptic: The apparent path of the Sun through the sky over a year.

III. Study Tips

- Use visual aids (images, diagrams).
- Create flashcards for planet facts.
- Draw diagrams of the solar system, labeling distances and sizes.
- Practice identifying planets in the night sky using star charts or astronomy apps.
- Practice defining and drawing the astronomical terms.

By studying these points, you should be well prepared to answer the questions on the planets and astronomical terms.

3rd Graders Only - Tower Building (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build a strong, stable tower using paper straws and masking tape to hold a mass of 300 grams. They will also answer questions on a written assessment on the types and building of towers.

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

Spirit of the Problem:

- ➢ **The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).**
- ➢ **It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.**

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

- Writing Utensils
- **Optionally**: a ruler/straightedge and protractor. **Scissors.**

Materials Provided at Event:

- 30 ≈ 20 cm paper drinking straws
- 1 meter of 2.54 cm tape
- an object with a mass of 300 grams
- 1 ≈ 5 x 5 x 0.6 cm square of plywood to place on top of the tower for testing

The Competition:

1. **Written Test**
   - **a.** The team will take a short assessment on the types and building of towers.

2. **Building Phase**
   - a. Teams will construct a tower that rises the greatest possible distance while supporting the 300-gram weight **placed at the highest point** for 20 seconds.
   - b. The tower must have a way at its highest point to place the 5 x 5 x 0.6 cm block.

c. Teams may cut the tape into any shape or size.
d. <u>The straws may be cut or left whole depending on team preference.</u>
e. The Event Supervisor will record the amount of any straws left for each team.

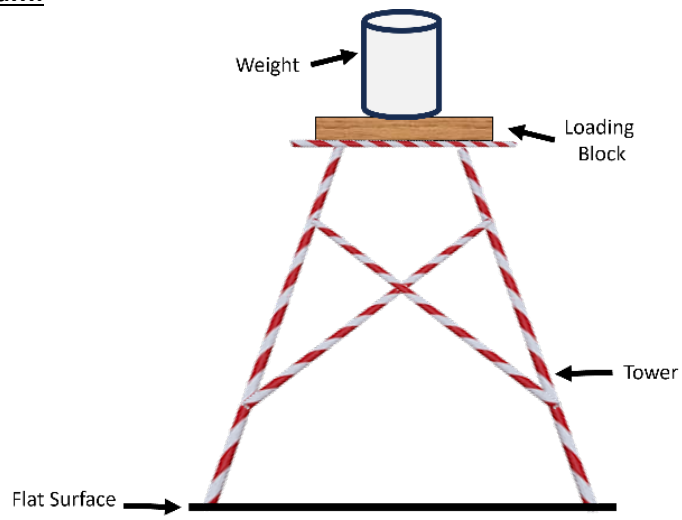
3. **<u>Tower Testing Phase</u>**
   a. Teams will place the tower on a flat even surface.
   b. All support parts of the tower must rest on top of the flat surface.
   c. No sticky part of the tape may touch any part of the flat surface
   d. The Event Supervisor will measure the height of the tower to the nearest millimeter.
   e. To begin testing, the teams will place the 5 x 5 x 0.6 cm wood block on top of their structure (The supervisor will not add the height of the block to the height of the tower measurement).
   f. Timing begins when teams place the mass on top of the wood block and remove their hand
   g. Testing will end when the tower fails to hold the object or the end of the 20 seconds
   h. The Event Supervisor or appointed judge will be the official timekeeper

4. <u>Event Supervisor Records:</u>
   a. Height of tower to the nearest millimeter
   b. Time to structural failure to the nearest 1/100th of a second
   c. Amount of unused straws
   d. Team assessment score

5. <u>Scoring:</u>
   a. Acronyms
      i. Competition Height Score (CHS) = the longest flight time for all teams
      ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
      iii. Final Score (FS)
      iv. Team Height Score (THS)
      v. Team Assessment Score (TAS)
   b. <u>Final Score (FS) = Assessment Score (TAS) + Time Score (THS)</u>. The maximum score is 100 points.
      i. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
      ii. Time Score = (THS ÷ CHS) x 50 points; rounded to the 100th place value
   c. Example
      i. (CAS) = 9. The team scores 4 on the assessment. (TAS) for the team= (4 ÷ 9) x 50 = 22.22 points
      ii. (CHS) = 450 mm. The team's height 375 mm. (THS) for the team= (1.45 ÷ 3.56) x 50 = 41.67 points
      iii. (FS) = 22.22 + 41.67 = 63.89 points

6. <u>Tiebreakers:</u>
   a. Time to structural failure
   b. Least amount of straws
   c. Best assessment score

Competition Diagram:



Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

i. Building for Hurricanes: Engineering Design Challenge

ii. Teach Engineering - Straw Towers to the Moon

Study Guide: Types and Building of Towers

I. Types of Towers

- By Function:
  - Communication Towers: Cell phone towers, radio towers, TV broadcast towers.
  - Observation Towers: Lighthouses, fire towers, observation decks.
  - Religious Towers: Church steeples, minarets (Islamic), pagodas (Buddhist).
  - Fortification Towers: Castle towers, watchtowers.
  - Water Towers: Store water for distribution.
  - Wind Turbines: Generate electricity from wind power.
  - Transmission Towers: Support power lines.
- By Structure:
  - Freestanding Towers: Supported by their own weight (e.g., Eiffel Tower).
  - Guyed Towers: Supported by cables anchored to the ground.
  - Lattice Towers: Made of a framework of interconnected beams.
  - Monopole Towers: Single, vertical poles.

II. Building Towers

- Planning and Design:
  - Purpose: What is the tower used for?
  - Location: Site selection, considering factors like wind, soil conditions, and proximity to people.
  - Height and Size: Determine the necessary dimensions.
  - Materials: Choose appropriate materials (steel, concrete, wood) based on strength, durability, and cost.

    - Engineering Principles: Apply concepts of physics and engineering (e.g., center of gravity, stability).
- Construction Process:
    - Foundation: Build a strong foundation to support the weight of the tower.
    - Assembly: Construct the tower using prefabricated parts or on-site construction.
    - Installation: Install equipment (e.g., antennas, lights, elevators).
    - Testing and Maintenance: Conduct thorough inspections and regular maintenance.

III. Key Concepts

- Stability: How towers are designed and built to withstand forces like wind, earthquakes, and gravity.
- Center of Gravity: The point where an object's weight is balanced.
- Structural Integrity: The ability of a structure to withstand loads without collapsing.
- Materials Science: Understanding the properties of different materials used in construction.

IV. Famous Towers

- Eiffel Tower (Paris): Iconic lattice tower, symbol of France.
- Leaning Tower of Pisa (Italy): Famous for its tilt.
- CN Tower (Toronto): Tallest freestanding structure in the Western Hemisphere.

Study Tips

- Visual Learning: Look at pictures and videos of different types of towers.
- Hands-on Activities: Build simple models of towers using building blocks or other materials.
- Research: Explore specific towers that interest you.
- Relate to Real Life: Observe towers in your community and discuss their purpose and construction.

This study guide provides a general overview. Remember to review any specific materials or notes provided by your teacher. Good luck with your assessment!

Anatomy - Nervous System (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on the nervous system with an emphasis on the function of the brain.

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

Spirit of the Problem:

➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).

➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Requirements: None

Teams must bring:

- Writing Utensils

The Competition:

Students will take a written test of 25 – 50 questions to answer topic questions on the human nervous system. The questions will include but are not limited to

- Neurons - Anatomy and physiology of neurons including impulses
- Brain & Spinal Cord - Structure and Function
- Central and Peripheral Nervous System - Similarities and differences
- Somatic and Autonomic Nervous System
- Effects of the drugs on nervous system
- Types of sensory organs - General & Special Senses
- Mechanism of Proprioception
- Physiology of Sight, Smell, Hearing, Taste, and Balance

Scoring:

a. Points will be awarded for each correct response
b. Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or the Event Supervisor

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
  - Your Brain & Nervous System

- The Brain in Space Educator Guide [3MB PDF file]
- **Your Amazing Brain!**
- Woollcott, Tory, and Alex Graudins. *The Brain: The Ultimate Thinking Machine*. First Second, 2018.

Nervous System Study Guide

This study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

1. What is the Nervous System?
    a. The nervous system is a complex network of nerves and cells that transmit messages throughout the body.
    b. It allows us to sense the world around us, think, move, and feel.
2. Main Parts of the Nervous System
    a. Central Nervous System (CNS):
        i. Brain: The control center, responsible for thinking, feeling, and controlling most body functions.
        ii. Spinal Cord: Connects the brain to the rest of the body, transmitting messages between them.
    b. Peripheral Nervous System (PNS):
        i. Nerves: Carry messages to and from the CNS.
        ii. Sensory Nerves: Carry information *from* the body *to* the CNS (like feeling a hot stove).
        iii. Motor Nerves: Carry messages *from* the CNS *to* the body (like telling your muscles to move).
3. Functions of the Brain
    a. Control Center:
        i. Receives and Processes Information: Gathers information from our senses (sight, sound, touch, taste, smell) and processes it to understand the world.
        ii. Initiates and Coordinates Movement: Tells your body how to move, from walking to playing sports.
        iii. Regulates Vital Functions: Controls things like breathing, heartbeat, and body temperature.
    b. Higher-Level Functions:
        i. Thinking and Learning: Allows us to think, learn, remember, and solve problems.
        ii. Language: Helps us understand and use language.
        iii. Emotions: Controls our feelings like happiness, sadness, and anger.
4. Key Brain Parts & Their Functions
    a. Cerebrum: The largest part, responsible for most of our thinking, feeling, and moving.
    b. Cerebellum: Controls balance and coordination.
    c. Brain Stem: Connects the brain to the spinal cord, controls vital functions.
5. How Nerves Communicate
    a. **Nerves send messages using electrical signals.
    b. These signals travel along the nerves very quickly.
6. Taking Care of Your Nervous System
    a. Eat healthy foods: Fruits, vegetables, and whole grains.
    b. Get enough sleep: 7-9 hours per night.
    c. Exercise regularly: Physical activity helps keep your brain healthy.
    d. Avoid drugs and alcohol: These can damage the brain.
7. Practice Questions:
    a. What are the two main parts of the nervous system?
    b. What is the brain's main function?
    c. What are some ways to take care of your nervous system?

    d. How do nerves send messages?
8. Cerebrum:
    a. Largest part of the brain.
    b. Divided into two hemispheres (left and right) connected by the corpus callosum.
    c. Responsible for:
        i. Higher-level functions: Thinking, feeling, moving, interpreting sensory information (sight, sound, touch).
        ii. Four lobes:
            1. Frontal: Planning, movement, personality, speech.
            2. Parietal: Sensory processing, spatial awareness.
            3. Temporal: Hearing, memory, language comprehension.
            4. Occipital: Vision.
9. Cerebellum:
    a. Located beneath the cerebrum.
    b. Coordinates movement, maintains balance, and posture.
10. Brainstem:
    a. Connects the brain to the spinal cord.
    b. Controls vital functions:
        i. Breathing
        ii. Heart rate
        iii. Body temperature
        iv. Sleep-wake cycles
11. Other Important Structures:
    a. Thalamus: Relays sensory information to the cerebral cortex.
    b. Hypothalamus: Regulates body temperature, hunger, thirst, and other important functions.
    c. Pituitary gland: Controls other endocrine glands in the body.
    d. Limbic system: Involved in emotions, learning, and memory (includes the amygdala and hippocampus).
    e. Basal ganglia: Involved in movement and coordination.

Astronaut Lander (Coach Scheduled Testing - 45 minutes)

Description: The partners will build a landing device that will safely protect a simulated astronaut from injury when landing from a two-story stairwell. They will also answer questions on a written assessment about the forces and factors experienced by astronauts when landing back on Earth after a stay in space.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Materials Provided at Event:

- Scissors
- 1 - piece of cardboard, approximately φ 10 x 13 cm
- 1 - 237 ml paper cup (the capsule)
- 3 - index cards φ 8 x 13 cm
- 1 - meter of string
- 1 - regular marshmallow (representing an astronaut) φ 2.54 diameter by 3.8 cm height
- 10 - mini marshmallows φ 0.6 cm diameter by 0.9 cm height
- 3 - rubber bands, choose from length sizes #64, #33, #19, sizes may be mixed
- 4 - paper straws
- 1 - meter of 2.54 cm masking tape
- 1 - #2 sized paper coffee filter
- 1 - #6 sized paper coffee filter

Construction Phase: Timed 25 Minutes

1. **Building**

a. The Event Supervisor will announce the distance from the second-floor railing to the ground floor at the start of the construction phase.
b. The partners:
    i. will build an astronaut lander using the provided materials. They do not have to use all of the materials, must use the paper cup
    ii. may cut the materials, **except the marshmallows and the paper cup,** to any size needed or leave them whole
    iii. may not create a method or use tape to keep the marshmallow inside the cup
    iv. may not build any part of their device within 10 cm directly over the top of the cup lip
    v. will announce to the Event Supervisor their estimate of the flight time of their lander during this stage

2. Written assessment

a. The partners will answer questions on a written assessment about the forces and factors experienced by an astronaut when landing back on Earth after a stay in space.

3. Launch Phase:

a. The partners will and at the direction of the Event Supervisor:
    i. place the regular marshmallow in the provided cup
        1. Success is where the marshmallow astronaut does not exit the capsule when landing
        2. The marshmallow may not be wedged or taped into the provided cup
    ii. hold their lander so that the bottom of the lander is parallel to the safety railing of the stairwell and announce to the Event Supervisor they are ready to drop
    iii. after receiving a reply from the supervisor, they will then use a 4-point count down, such as 3, 2, 1, drop, to start the lander falling
    iv. may hold the lander in any manner they deem fit as long as they adhere to rule 2.a.ii
    v. may not move the lander upwards while they are letting go
    vi. The event supervisor and a judge will measure and record the time for the lander to reach the ground/floor
    vii. Time will continue if the lander bounces off an object but will stop when the lander gets stuck or comes to a complete stop
    viii. Time will be recorded in seconds to the nearest 1/100.

Tier Violations

A tier violation is a penalty to a team for not following the build guidelines or the spirit of the problem as judged by the Event Supervisor. Teams placed in tiers 2 or 3 will receive scores reduced by 20% and 30% respectively.

1. Tier 1. The team lander meets all of the building requirements, and the team follows the Spirit of the Problem guidelines, and the astronaut landed safely
2. Tier 2. The team lander is deemed to have a construction fault, or their astronaut falls out of the cup
3. Tier 3. The team did not follow the Spirit of the Problem guidelines

Event Supervisor Records:

1. The estimate given by the pair
2. The time to the nearest 1/100 of a second that the lander stays aloft
3. Written test scores

Scoring:

1. Acronyms
    a. Competition Flight Score (CFS) = the longest flight time for all teams
    b. Competition Assessment Score (CAS) = the highest assessment score for all teams

c. Final Score (FS)
d. Team Time Score (TTS)
e. Team Assessment Score (TAS)

2. Final Score (FS) = Assessment Score (TAS) + Time Score (TTS). The maximum score is 100 points.
   a. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
   b. Time Score = (TTS ÷ CFS) x 50 points; rounded to the 100th place value

3. Example
   a. (CAS) = 15. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 15) x 50 = 30 points
   b. (CFS) = 3.56 seconds. The team's flight time is 1.45. (TTS) for the team= (1.45 ÷ 3.56) x 50 = 20.4 points
   c. (FS) = 30 + 20.4 = 50.4 points

Tiebreakers

The smallest difference between the actual and estimated flight times
Correct answers on selected written assessment questions

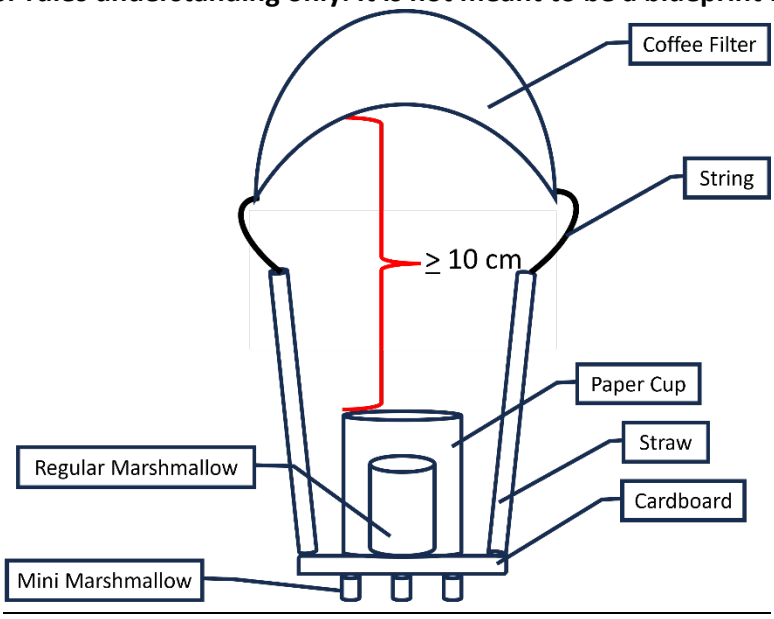
Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

- Mars Lander Challenge (.pdf download)
- Make an Astronaut Lander
- Returning from Space: Re-entry
- The Human Body in Space
- What Happens to the Human Body in Space?

Competition Diagram:

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



Study Guide: Landing Device for a Simulated Astronaut

I. Understanding the Challenge

- The Problem:
  - Design and build a device that will protect a marshmallow (simulated astronaut) from injury during a drop from a two-story stairwell.
  - Injury is defined as the marshmallow being crushed or significantly deformed.
- Key Considerations:
  - Forces at Play:
    - Gravity: The constant downward force pulling the marshmallow towards Earth.
    - Air Resistance: The force opposing the marshmallow's downward motion.
    - Impact Force: The sudden force exerted upon landing.
  - Factors Affecting Landing:
    - Height of the drop (constant in this case)
    - Mass of the marshmallow (relatively constant)
    - Materials used for the landing device
    - Design and structure of the landing device (shape, cushioning, etc.)

II. Design Process

- Brainstorming:
  - Generate a variety of design ideas.
  - Consider different materials (paper, cardboard, foam, fabric, etc.)
  - Research existing technologies (airbags, parachutes, crumple zones).
- Prototyping:
  - Create small-scale models of your chosen design.
  - Test the prototypes with shorter drops to observe their performance.
  - Analyze the results and identify areas for improvement.
- Refining the Design:
  - Make adjustments to the materials, structure, or cushioning based on test results.
  - Iterate on the design to optimize its performance.

III. Building the Landing Device

- Gather Materials:
  - Acquire all necessary materials based on your final design.
- Construction:
  - Carefully construct the landing device according to your plans.
  - Ensure the device is sturdy and can withstand the impact of the drop.

IV. Testing and Evaluation

- Conduct the Drop Test:
  - Drop the marshmallow within the landing device from the two-story stairwell.
  - Observe the landing and assess the condition of the marshmallow.
  - Record the results of the test.
- Analyze Results:
  - Did the landing device successfully protect the marshmallow?
  - Identify any areas of failure or areas for further improvement.

V. Written Assessment Preparation

- Forces and Factors in Spaceflight:
  - Launch:
    - Forces experienced during liftoff (thrust, gravity, air resistance).
    - Factors affecting launch trajectory and speed.
  - Orbit:

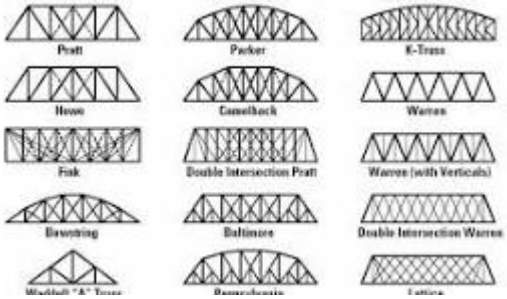
        - State of weightlessness and the concept of microgravity.
        - Factors influencing the stability of an orbit (speed, altitude).
    - Re-entry:
        - Forces experienced during re-entry (friction, heat).
        - Role of the atmosphere and heat shield in protecting the spacecraft.
        - G-forces experienced by astronauts during re-entry.
    - Landing:
        - Forces experienced during landing (gravity, air resistance, impact).
        - Landing techniques (parachutes, rockets, controlled descent).
        - Factors affecting a safe landing (atmospheric conditions, landing site).

VI. Study Tips

- Review Class Notes:
    - Re-read notes on forces, motion, and space travel.
- Conduct Research:
    - Explore online resources and books about spaceflight and landing technologies.
- Practice Explaining Concepts:
    - Explain the concepts of gravity, air resistance, and Newton's Laws to someone else.
- Prepare for the Written Assessment:
    - Review the study guide thoroughly.
    - Practice answering sample questions related to forces and spaceflight.

Bridge Building (Coach Scheduled Testing - 45 Minutes)

Description: Each team will **build the tallest Truss Bridge** to span a 30-centimeter distance while holding a 300-gram mass or 500-gram mass for 30 seconds. They will also answer questions on a written assessment about the techniques for building bridges and the types of 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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

- Pencil, pen or marker, a ruler or straight edge, and one pair of scissors for each team member.

Materials Provided at Event:

- 30 ≈ 20 cm paper drinking straws
- 1 meter of 2.54 cm tape
- 2 objects with masses of 300 and 500 grams
- 2 ≈ 5 cm x 9.5 cm x 30.5 cm support structures
- 1 ≈ 5x5x0.6 cm loading block with a mass of 20 grams

1. **Construction Phase: Timed 25 Minutes**

a. Building

i. Each team constructs one truss bridge to span a 30.0 cm gap between the two support structures while supporting a 300- or 500-gram mass placed on a loading block at the top and center point of the truss.

ii. The bridge must be constructed entirely of the provided straws and tape. The straws and tape may be cut into any shape or size and the straws may crimped to slide inside each other.

iii. The bridge must have a width of at least 10.0 cm at its center point, outside edge to outside edge.

iv. The bridge may not have any cross members on the inside that would prohibit a loading block sized piece of wood form passing through its entire length in any orientation

v. Both masses will be used to test the bridge, starting with the smaller one. The bridge must support at least one of the masses for 30 seconds

vi. Teams using tools or materials other than those listed above will be ranked below all other teams

b. Written assessment: The pair of participants will answer the assessment questions **concurrently with the 25-minute construction phase**. The assessment will contain questions on types of bridges, building techniques, and forces within bridges

2. <u>Competition Phase:</u>

a. The Event Supervisor (ES) will place the 2x4 inch lumber supports parallel to each other and 30.0 cm apart on a level flat surface

b. The competitors will set their bridge across the support structures. No sticky part of the tape may touch the top or sides of the supports

c. The Event Supervisor (ES) will verify and record that the bridge spans the gap, the width is at least 10.0 cm, and the loading block can pass through the length of the bridge. The ES will also measure and record the bridge's height at the center to the nearest millimeter and the number of unused, complete straws.

d. The competitors will place the 5cm by 5cm loading block on the top chord of their truss at the center point between the supports. They will then place the 300-gram mass on the loading block, and the ES will start the timer. Once they place the mass, the competitors may not touch their bridge.

e. Testing for a mass will end when the bridge fails to hold the mass, any part of the bridge sags and touches the tabletop, or 30 seconds elapses.

f. If the bridge supports the 300-gram mass for 30 seconds, the ES will repeat the test with the 500-gram mass.

3. <u>Event Supervisor Records:</u>

a. Whether the bridge spans the gap

b. Whether the width is at least 10.0 cm

c. Whether the loading block can pass through the length of the bridge

d. The total height of the bridge at the center to the nearest millimeter

e. Number of unused, complete straws

f. Time to structural failure for each mass

4. <u>Scoring:</u>

I. Acronyms

a. Competition Height Score (CHS) = the height of the tallest bridge for all teams

b. Competition Assessment Score (CAS) = the highest assessment score for all teams

c. Team Assessment Score (TAS) = team score on the written test

d. Team Height Score (THS) = the height of the bridge in the center, measured to the nearest millimeter

II. Team's Score = 0.5 x (THS ÷ CHS) + 0.5 x (TAS ÷ CAS) x any multipliers listed below

III. If the bridge supports the 500-gram mass for 30 seconds, the height score will be multiplied by 1.2

IV. If the bridge width is less than 10.0 cm or the loading block cannot pass through the bridge, the height

score will be multiplied by 0.5

V. If the bridge cannot span the gap, the height score is 0

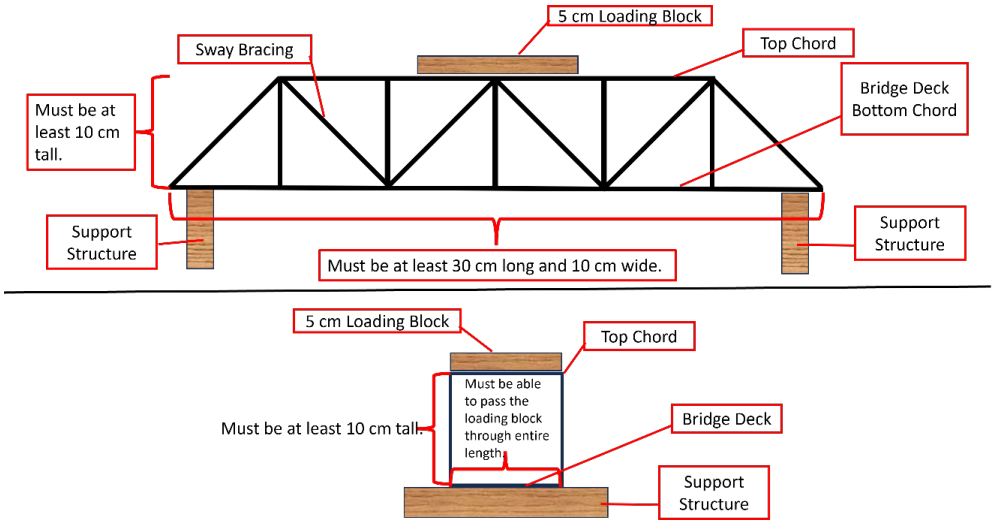
5. Tiebreakers

a. Largest number of unused, complete straws remaining
b. Time to structural failure in the 500-gram test
c. Time to structural failure in the 300-gram test

Study Resources: Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events. The listed resources are meant as a starting point. It is up to the competitor to research further.

a. https://scioly.org/wiki/index.php/Bridge
b. https://www.youtube.com/watch?v=oVOnRPefcno
c. https://thestemlaboratory.com/straw-bridges/
d. https://www.stem-inventions.com/truss-bridge (This site uses materials that are different from the one used for this event.)

Competition Diagrams:



Truss Bridge Study Outline

Caution, this is a sample outline. It was Gemini AI generated and is meant as a starting point! It may or may not contain topics occurring on the written test.

1. Introduction to Truss Bridges
    a. What is a truss bridge?
2. Basic components of a truss bridge:
    a. Verticals
    b. Diagonals
    c. Chords (top and bottom)
3. Advantages of truss bridges
4. Disadvantages of truss bridges
5. Types of Truss Bridges
    a. **Simple Truss Bridges:**
        i. Pratt Truss
        ii. Howe Truss
        iii. Warren Truss
        iv. Parker Truss

   b. **Complex Truss Bridges:**
      i. K-Truss
      ii. Bowstring Truss
      iii. Through Truss
      iv. Deck Truss
6. Construction Techniques
7. **Planning and Design:**
   a. Load calculations
   b. Material selection
   c. Structural analysis
8. **Foundation Construction:**
   a. Pier and abutment construction
   b. Soil testing and preparation
9. **Erection of the Truss:**
   a. Methods of erection (crane, cantilever, etc.)
   b. Connection techniques (bolting, riveting, welding)
10. **Deck Construction:**
   a. Placement of the deck on the truss
   b. Waterproofing and paving
11. **Finishing Touches:**
   a. Painting and maintenance
   b. Safety inspections
   c. Forces in Truss Members
12. **Tension and Compression:**
   a. Understanding the forces acting on truss members
   b. Identifying members in tension and compression
13. **Method of Joints:**
   a. Analyzing forces in truss members using equilibrium equations
14. **Method of Sections:**
   a. Analyzing forces in truss members by cutting sections through the truss
   b. Real-World Applications
15. **Famous Truss Bridges:**
   a. Golden Gate Bridge
   b. Brooklyn Bridge
   c. Other notable examples
16. **Modern Innovations in Truss Bridge Design:**
   a. Use of advanced materials (e.g., composite materials)
   b. Innovative construction techniques
   c. Sustainable design principles
17. **Study Tips:**
   a. **Visual Learning:** Use diagrams and images to understand the different types of truss bridges and their components.
   b. **Hands-on Activities:** Build a model truss bridge to visualize the concepts.
   c. **Practice Problems:** Solve problems involving force analysis in truss members.
   d. **Review Key Terms:** Familiarize yourself with the vocabulary related to truss bridges.
   e. **Create Flashcards:** Use flashcards to memorize key concepts and definitions.
   f. **Study Groups:** Discuss the material with classmates and ask questions.

Bungee Egg Drop (Coach Scheduled Testing - 45 Minutes)

Description: Design and construct a bungee cord system to protect a raw egg from breaking that jumps from the top of a two-story stairwell. They 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

Spirit of the Problem:

➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).

➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **ANSI Z87 D3 Splash/Droplet standards; goggles must be worn during all event testing.**
- **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.**

Category C: Indirect Vent Goggles

Eyeglasses and Safety Glasses are not safety rated for this event!

Materials Provided at Event:

- An assortment of rubber bands length sizes #64, #33, #19, and #117B.
- 50 cm of 2.54 cm masking tape
- 1 large egg
- 1 sandwich or snack sized plastic bag

1. **Construction Phase: Timed 25 Minutes**
   a. **Building**
      i. The Event Supervisor will announce the Target Drop Distance (TDD) from the second-floor railing to the artificial horizon at the start of the construction phase.
      ii. The artificial horizon is a line drawn at a zero point in the middle of a paper chart labeled from +100 cm to -100 cm.
      iii. The partners:
         a. 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 them together in any manner they choose
         b. choose a room temperature egg from those provided
         c. seal their egg in the provided plastic bag. Any egg leakage upon breaking will be a tier violation
         d. attach their bungee cord to the bag by tying a knot, using the masking tape or both. No masking

tape may be used to support or strengthen the egg or the plastic bag.

e. announce to the Event Supervisor their estimate of how close to the artificial horizon their egg will stop on its best drop.

b. Written assessment

The pair 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. On their assessment paper the team will state their estimated difference their egg will stop before hitting the floor.

2. Competition Phase:

a. At the direction of the Event Supervisor, the partners will:
   i. attach their bungee end opposite the encased egg to the Retaining Hook on the Bungee Jump Platform, making sure that the rest of their rubber bands are hanging loose over the front of the platform
   ii. place and hold the egg at the end of the jump platform in a vertical position
   iii. announce to the Event Supervisor they are ready to drop and wait for a reply from the supervisor that they have the camera ready, then count down from 3 and open their hand letting the egg free fall forward off the platform. DO NOT PUSH THE EGG!

b. The event supervisor will set their video recording device to show the entire Artificial Horizon Chart (marked in 1 centimeter increments from -100cm to +100 cm) and record the fall in slow motion.

c. The students will receive two drops and may make changes to their bungee in between the drops.

d. An egg is deemed to be broken if there is visible leakage from its shell. An egg may have cracks and still not leak. To determine if there is no leakage the egg will be removed from the plastic bag by the team and rolled on a paper towel. Any wet areas on the towel will indicate leakage

3. Event Supervisor Records:

i. The estimate given by the pair
ii. Slow motion video of the egg with the Artificial Horizon Chart in the background
iii. The distance from the horizon, plus or minus, to the nearest centimeter mark
iv. Written assessment scores

4. Tier Violations

a. A tier violation is a penalty to a team for not following the build guidelines or the spirit of the problem as judged by the Event Supervisor. Teams placed in tiers 2 or 3 will receive scores reduced by 20% and 30% respectively.
   i. Tier 1. The team device meets all the building requirements, the egg remains unbroken, and the team follows the Spirit of the Problem guidelines
   ii. Tier 2. The team device is deemed to have a construction or time fault violation, and the team follows the Spirit of the Problem guidelines
   iii. Tier 3. The team did not follow the Spirit of the Problem guidelines.

5. Scoring:

a. Score Computation
   i. Final Score (FS) = AS + max(DS1, DS2)
   ii. Assessment Score (AS) = 50 x RAS ÷ max(RAS for all teams)
   iii. Raw Assessment Score (RAS) = team's score on the assessment in whatever point system is awarded by the assessment's questions.
   iv. Drop Score 1 (DS1) = 50 x (TDD - DD1) ÷ max(TDD - DD1 and TDD - DD2 for all teams)

v. Drop Score 2 (DS2) = 50 x (TDD - DD2) ÷ max(TDD - DD1 and TDD - DD2 for all teams)
vi. Target Drop Distance (TDD) = the announced distance from the drop location to the artificial horizon. The minimum TDD will be 200cm.
vii. Drop Distance 1 (DD1) = 200cm if the egg drops below the artificial horizon, otherwise the distance from zero (the artificial horizon) to the lowest point of travel of the egg on the first egg drop. If the egg's lowest point is too high to be measured, then DS1 = 200cm.
viii. Drop Distance 2 (DD2) = 200cm if the egg drops below the artificial horizon, otherwise the distance from zero (the artificial horizon) to the lowest point of travel of the egg on the second egg drop. If the egg's lowest point is too high to be measured, then DS2 = 200cm.

b. Example
i. The team's raw assessment score is 6, and the best raw assessment score is 9. (AS) for the team= 50 x (6 ÷ 9) = 33.33 points
ii. The team's first drop distance is below the artificial horizon, and their second drop distance is 13 cm. The best drop distance among all the teams is 7 cm, and the target drop distance is 400 cm. Then DS1 = 50 x (400 - 200) ÷ (400 - 7) = 25.45, and DS2 = 50 x (400 - 13) ÷ (400 - 7) = 49.24
iii. FS = 33.33 + max(25.45, 49.24) = 82.57

6. Tiebreakers

i. The smallest difference between the actual and estimated distances
ii. Correct answers on selected written assessment questions

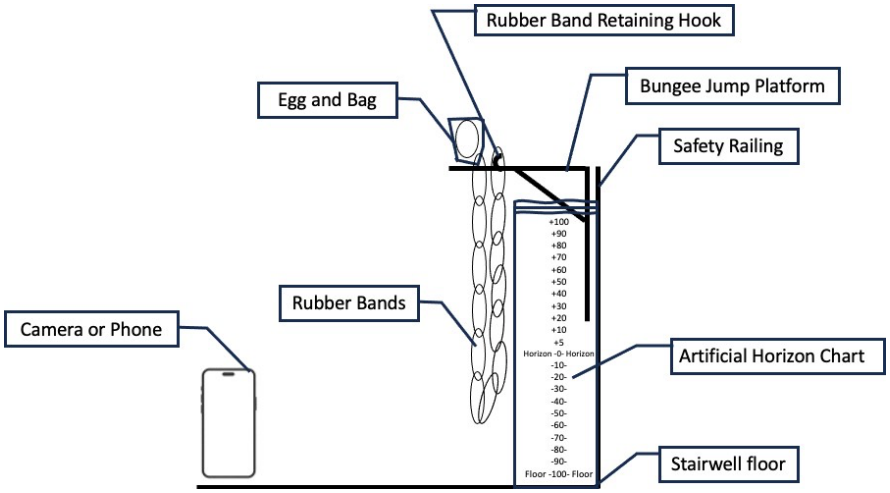
Possible Resources:

b. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
c. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

- Egg Bungee - Griffin Museum of Science and Industry
- Bungee-Jumping Egg – Flinn Scientific (.pdf download)
- Egg Bungee Teacher Notes – Science Scope, February 2005 (.pdf download)

Competition Diagram (not to scale):

Note: The paper chart does not have to be placed so that the -100 is at the stairwell floor.



Bungee Egg Drop Study Outline

Caution, this is a sample outline. It was Gemini AI generated and is meant as a starting point! It may or may not contain topics occurring on the written test.

I. Core Concepts

- Law of Conservation of Energy:
  - Understand the principle: Energy cannot be created or destroyed, only transformed from one form to another.
  - Identify different forms of energy involved in the egg drop:
    - Gravitational Potential Energy (GPE): Energy stored in an object due to its height.
    - Kinetic Energy (KE): Energy of motion.
    - Elastic Potential Energy (EPE): Energy stored in a stretched or compressed elastic material (like the bungee cord).
- Gravitational Potential Energy (GPE):
  - Formula: GPE = mgh (where m = mass, g = acceleration due to gravity, h = height)
  - Factors affecting GPE: Mass of the object and its height.
- Kinetic Energy (KE):
  - Formula: KE = 1/2 mv^2 (where m = mass, v = velocity)
  - Factors affecting KE: Mass of the object and its velocity.
- Elastic Potential Energy (EPE):
  - Understand how EPE is stored in the bungee cord.
  - Recognize that the amount of EPE depends on the stiffness (spring constant) of the cord and how much it is stretched.

II. Bungee Cord System Design

- Materials:
  - Gather necessary materials: Rubber bands, metric measuring device, plastic sandwich bags, plastic eggs for size filled with clay for weight, tape.
- Design Considerations:
  - Cord Selection:
    - Experiment with different band thicknesses and lengths.
  - Testing and Refinement:
    - Conduct initial tests from lower heights.
    - Adjust the cord length.

III. Experimental Procedure

- Safety Precautions:
  - Wear safety goggles.
  - Ensure a clear drop zone with no obstacles.
  - Have a spotter to assist during the drop.
- Data Collection:
  - Measure the height of the drop.
  - Record observations during the drop (e.g., cord stretch, egg movement).
- Data Analysis:
  - Analyze the results of the egg drop.
  - Determine if the egg survived the jump.
  - Identify areas for improvement in the design.

IV. Written Assessment

- Questions on Energy Concepts:
  - Explain the Law of Conservation of Energy in the context of the egg drop.

    - Describe how GPE, KE, and EPE change throughout the jump.
    - Calculate GPE, KE, or EPE at different points in the jump (if applicable).
    - Analyze how changes in height, velocity, and cord stretch affect energy transformations.
- Design and Procedure:
    - Explain the design choices made for the bungee cord system.
    - Describe the experimental procedure and any modifications made during testing.
    - Discuss the successes and failures of the design.
- Analysis and Conclusions:
    - Analyze the data collected during the experiment.
    - Draw conclusions about the effectiveness of the bungee cord system.
    - Identify areas for future improvements.

V. Tips for Success

- Work as a team: Collaborate to brainstorm ideas, conduct experiments, and analyze data.
- Sketch and diagram: Draw diagrams of the bungee cord system and the energy transformations.
- Use a table: Organize data and observations in a clear and concise table.
- Practice calculations: Practice calculating GPE, KE, and EPE using sample problems.
- Review notes and concepts: Thoroughly review the concepts of energy, forces, and motion.

Note: This is a general outline, and the specific content and depth of the study guide may vary depending on the grade level and the specific learning objectives of the activity.

Remember to:

- Consult with your teacher for specific instructions and requirements.
- Ask questions if you are unsure about any of the concepts or procedures.
- Have fun with the experiment!

Data Investigations (On the team schedule - 30 minutes)

Description: Teams will demonstrate an understanding of data collection and its use in scientific experimentation to include answering questions on data collected during a scientific experiment.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils, and a four function Calculator.

Safety Requirements: None

The Competition:

- The written assessment will contain 25-50 questions on extremophiles.
- Teams will demonstrate understanding of this content in any or all the following ways:
    - Collect data with metric measuring devices (length, mass, or volume) and represent that data in a correctly labeled graph or data table
    - Plot data points, make and interpret data tables, draw and interpret graphs, including what trends can be predicted from the data shown
    - Make estimates of data between or beyond the data points given.
    - Calculate fractions or percentages based on charts, tables or data.
    - Calculate the mean, median, and mode for a set of data.
    - Distinguish between accuracy and precision and identify outliers in a set of data.
    - Identify types of questions (numerical, categorical, data that changes over time) when collecting data.

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or the Event Supervisor prior to the competition.

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
- Data Crunchers | NC Science Olympiad

Data Collection & Scientific Experimentation Study Guide and Outline

Outline:

This outline should provide a solid foundation for your assessment on data collection and its use in scientific experimentation.

1. Understanding Data Collection in Scientific Experiments
    a. What is Data?
        i. Information gathered during an experiment.
        ii. Can be numbers (quantitative) or descriptions (qualitative).
        iii. Examples: measurements, observations, surveys.
    b. Why Collect Data?
        i. To answer scientific questions.
        ii. To test hypotheses.
        iii. To understand patterns and relationships.
        iv. To support conclusions.
    c. Methods of Data Collection
        i. Observations: Using senses to gather information.
        ii. Direct observations: Seeing, hearing, touching.
        iii. Indirect observations: Using tools like microscopes, thermometers.
        iv. Measurements: Using tools to collect precise data.
        v. Examples: rulers, scales, timers, graduated cylinders.
        vi. Surveys: Collecting information from people through questions.
        vii. Experiments: Conducting controlled tests to gather data.
    d. Organizing Data
        i. Tables: Arranging data in rows and columns.
        ii. Graphs: Visual representations of data.
        iii. Bar graphs: Comparing different categories.
        iv. Line graphs: Showing trends over time.
        v. Pie charts: Showing parts of a whole.
    e. Analyzing Data
        i. Looking for patterns, trends, and relationships in the data.
        ii. Calculating averages (mean, median, mode).
        iii. Identifying any unusual or unexpected results.
2. Answering Questions About Data
    a. Reading and Interpreting Data Tables and Graphs
        i. Understand the information presented.
        ii. Identify key features (labels, units, scales).
        iii. Extract specific data points.
    b. Drawing Conclusions from Data
        i. Determine if the data supports or refutes the hypothesis.
        ii. Explain the reasoning behind your conclusions.
        iii. Consider any limitations or sources of error in the data.
    c. Communicating Data
        i. Clearly and accurately present findings in written or oral reports.
        ii. Use graphs and tables to support your explanations.
        iii. Practice Scenarios

3. Analyze a hypothetical experiment:
    a. Given a scenario (e.g., plant growth experiment), identify the independent and dependent variables.
    b. Predict the type of data that would be collected.
    c. Suggest how the data could be organized and presented.
4. Interpret data from a provided table or graph:
    a. Answer questions about the data (e.g., "What trend is shown in the graph?", "What does this data point represent?").
    b. Draw conclusions based on the data.

Study Guide:

This study guide focuses on the key concepts of data collection and its use in scientific experimentation, including how to answer questions based on collected data. Remember that the specific content of your assessment may vary, so review any materials provided by your teacher.

1. What is Data?
    - Data is information gathered during an experiment.
    - It can be numbers, measurements, observations, or descriptions.
2. Why is Data Important in Science?
    - Scientists use data to:
        - Answer questions: Does fertilizer make plants grow taller?
        - Test hypotheses: Is my prediction correct?
        - Draw conclusions: What happened in the experiment?
        - Support or reject ideas: Does the evidence support my theory?
        - Communicate results: Share findings with others.
3. Types of Data
    - Qualitative Data:
        - Describes qualities or characteristics.
        - Uses words, pictures, or descriptions.
            - Examples: "The flower is red." "The dog was barking loudly."
    - Quantitative Data:
        - Uses numbers and measurements.
            - Examples: "The plant grew 5 centimeters." "The temperature was 25 degrees Celsius."
4. Collecting Data
    - Observations: Using your senses to gather information.
    - Measurements: Using tools like rulers, thermometers, scales, timers.
    - Surveys: Asking questions to gather information from people.
    - Experiments: Conducting controlled tests to gather data.
5. Organizing Data
    - Tables: A way to organize data in rows and columns.
    - Graphs: Visual representations of data (bar graphs, line graphs, pie charts).
6. Analyzing Data
    - Look for patterns: Are there any trends or relationships in the data?
    - Calculate averages: Find the mean, median, and mode.
    - Compare data: How do the results from different groups compare?
7. Answering Questions About Data
    - Read the data carefully: Pay attention to the units of measurement.

- Look for trends and patterns.
- Use the data to support your answers.

Example Questions:

1. What is the difference between qualitative and quantitative data?
2. Why is it important to collect data during an experiment?
3. How can you organize and display data?
4. What are some ways to collect data?
5. If you were testing the effect of different types of fertilizer on plant growth, what type of data would you collect?

Good luck with your assessment!

Extremophiles (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on the different types of Earth's extremophiles and how they survive in extreme conditions.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils

Safety Requirements: None

The Competition:
Students will take a written test to answer topic questions on extremophiles. The questions will include but are not limited to

- Extreme environments - Acidic, Alkaline, Altered by Humans, Extremely Cold, Extremely Hot, Hypersaline, Radiation, Under Pressure, Without Water, Without Oxygen
- What are extremophiles and the terms used to describe extremophiles
- Adaptations
- Extremophiles found in Yellowstone National Park

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or Event Supervisor prior to the competition.

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**

I. NASA Space Place:
   a. Often has articles and activities related to space exploration, which often includes information on extremophiles and their potential for life on other planets.

II. Kids Discover:
   a. May have articles or magazines specifically about extremophiles, presented in a kid-friendly way with engaging visuals.
III. National Geographic Kids:
   a. This website generally has excellent articles and videos on a wide range of science topics, and might include information on extremophiles.
IV. Science News for Students:
   a. Offers science news and articles written for middle and high school students, but some topics might be accessible to younger children with adult guidance.
V. Tips for Finding More:
   a. Use keywords: Search for terms like "extremophiles for kids," "life in extreme environments," "weirdest creatures on Earth" on search engines like Google or DuckDuckGo.
   b. Check educational websites: Look for websites from reputable educational institutions or science museums.
   c. Explore YouTube: Search for "extremophiles for kids" on YouTube to find educational videos.
VI. Microbial Life - Educational Resources
VII. Life in Extreme Heat - Yellowstone National Park (U.S. National Park Service)

Earth's Extremophiles: Study Guide

This study guide focuses on the different types of Earth's extremophiles and how they survive in extreme conditions.

What are Extremophiles?

- Extremophiles are organisms that thrive in environments that would be considered hostile or even deadly for most life on Earth.
- They are incredibly adaptable and have unique adaptations that allow them to survive in extreme conditions.

Types of Extremophiles:

- Thermophiles:
  - Love heat!
  - Live in hot environments like hot springs, deep-sea hydrothermal vents, and volcanic areas.
  - Adaptations:
    - Special enzymes that function at high temperatures.
    - Heat-resistant cell membranes.
- Psychrophiles:
  - Love the cold!
  - Live in icy environments like polar regions, glaciers, and deep-sea waters.
  - Adaptations:
    - Flexible cell membranes that remain fluid in cold temperatures.
    - Enzymes that function efficiently at low temperatures.
    - Antifreeze proteins that prevent ice crystal formation within their cells.
- Halophiles:
  - Love salt!
  - Live in extremely salty environments like salt lakes, salt marshes, and even inside salt crystals.
  - Adaptations:
    - High internal salt concentrations to balance the external environment.
    - Modified proteins that can function in high salt conditions.
- Acidophiles:

    - Love acid!
    - Live in highly acidic environments like acidic hot springs, mines, and the human stomach.
    - Adaptations:
        - Unique cell membranes and proteins that can withstand high acidity.
- Barophiles/Piezophiles:
    - Love pressure!
    - Live in deep-sea environments where the pressure is extremely high.
    - Adaptations:
        - Rigid cell walls that can withstand immense pressure.
        - Unique enzymes that function under high pressure.

Why are Extremophiles Important?

- Help us understand the limits of life on Earth.
- Provide insights into the possibility of life on other planets.
- Have potential applications in biotechnology and medicine.
    - Enzymes from thermophiles are used in industrial processes.
    - Extremophile adaptations can inspire new materials and technologies.

Key Concepts

- Extreme Environments: Understand the different types of extreme environments on Earth (hot, cold, salty, acidic, high pressure).
- Adaptations: Be able to explain how different types of extremophiles have adapted to survive in their extreme environments.
- Importance: Understand why the study of extremophiles is important for science and technology.

Practice Questions:

1. What are extremophiles?
2. What are some examples of extreme environments on Earth?
3. How do thermophiles survive in hot environments?
4. Why are psychrophiles important to study?
5. What are some potential applications of extremophile research?

Gravity Vehicle (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build a vehicle out of K'nex materials to travel a distance and stop as close to a designated finish point as possible. All building of vehicles will take place during the competition. This event has a written assessment on simple machines and the impacts of gravity and friction on wheeled vehicles.

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

Spirit of the Problem:

- The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams need to bring:

- A writing utensil
- Optionally - 1 vehicle concept diagram, no larger than 8.5" x 11"
- No other resources or tools allowed

Materials Provided at Event:

- K'nex Building materials
- Gravity Car Ramp 1 meter in height
- Golf Ball
- Score sheets, stop watches, and distance measuring devices

The Competition (25 minutes):

1. **Written assessment**

a. This assessment will cover the six simple machines and the impacts of gravity and friction on wheeled vehicles.
b. During the assessment the Event Supervisor will record the team estimate of how close they will come to the target
c. The assessment will be between 10 and 20 questions in length and will take place simultaneously will the vehicle building

2. <u>Construction Phase:</u>

<u>The team will:</u>

a. build a wheeled vehicle out of K'nex pieces to travel 5.0 meters and come to a stop on a target point
b. power their vehicle solely by the gravitational energy of rolling down the ramp
c. build their vehicle with a fixed point (e.g. a K'nex piece) extending from the front edge of the vehicle, 1-2 cm above the track surface
d. build their vehicle to transport a golf ball to the target spot
e. the golf ball must remain in the vehicle until the Event Supervisor completes the competition measurements
f. have a maximum of 25 minutes to construct and test their vehicle
g. time permitting, may have up to 3 test runs with their vehicle during the build time
h. not modify their vehicle after the construction period has ended

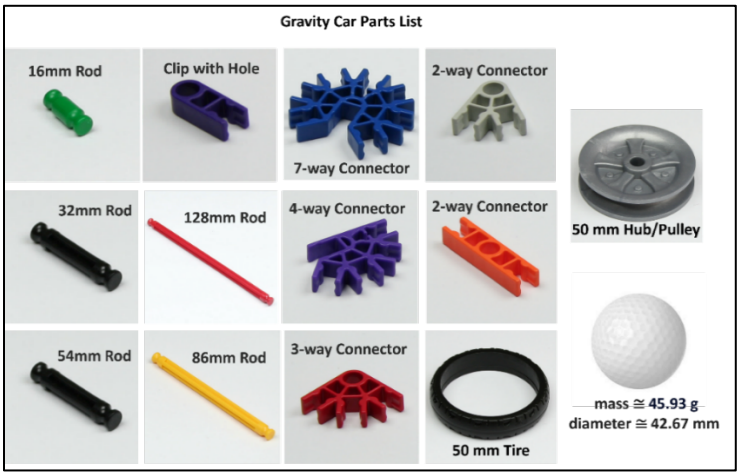
3. <u>The Ramp:</u>

a. will have multiple start lines at 20 cm intervals
b. will be 1 meter tall and long
c. will be 30 cm wide
d. will have a 10 cm concave bend

4. **<u>The Track:</u>**

a. will be a relatively smooth, hard surface
b. have a target point marked at 5.0 meters
c. have a center line from the center front of the ramp to the finish point
d. have a width of one meter

5. **<u>The Materials:</u>**



6. **Official runs:**
    a. **The team:**
        i. will have 2-minutes to make 2 official runs and will notify the Event Supervisor when they are ready (the run closest to the target point will count towards the team score)
        ii. may position the vehicle on the ramp at any of the start lines and in any orientation
        iii. may adjust the angle of the ramp left or right of the center line, but may not move it forward, backward or side to side
        iv. will need permission from the Event Supervisor to release their vehicle to start official runs
        v. will start their run with a 4-point count down, such as 3, 2, 1, go
        vi. use a one or two hand release and will not push the vehicle
        vii. will not chase their vehicle down the track, they must wait until they are called by the Event Supervisor to retrieve their vehicle

7. **Tier Violations**
    a. A tier violation is a penalty to a team for not following the build guidelines or the spirit of the problem as judged by the Event Supervisor. Teams placed in tiers 2 or 3 will receive scores reduced by 500 and 1000 points respectively.
        i. Tier 1. The team vehicle meets all the building requirements, and the team follows the Spirit of the Problem guidelines
        ii. Tier 2. The team vehicle is deemed to have a construction or time fault violations and the team follows the Spirit of the Problem guidelines
        iii. Tier 3. The team did not follow the Spirit of the Problem guidelines
    b. Possible construction or time violations
        i. The golf ball does not stay in the vehicle
        ii. A K'nex piece falls off the vehicle
        iii. The team continues to build after the 25-minute time
        iv. The team tries to rebuild or repair after their first official run

8. **Event Supervisor Records:**
    a. The estimated distance given by the team
    b. The distance from the target point to the fixed point at the front to the team vehicle
    c. Written test scores

9. **Scoring:**
    a. Acronyms
        i. Competition Distance Score (CDS) = the closest distance measurement from the target point to the fixed car point for all teams
        ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
        iii. Final Score (FS)
        iv. Team Distance Score (TDS)
        v. Team Assessment Score (TAS)
    b. Final Score (FS) = (TAS) + (TDS). The maximum score is 100 points.
        i. Assessment Score = (TAS ÷ CAS); rounded to the 100th place value
        ii. Distance Score = (CDS ÷ TDS); rounded to the 100th place value
    c. Example
        i. (CAS) = 13. The team scores 6 on the assessment. (TAS) for the team= (6 ÷ 13) = 23.07 points
        ii. (CDS) = 0.5 cm. The team's distance score is 25 cm. (TDS) for the team= (0.5 ÷ 25) = 0.2 points
        iii. (FS) = 23.07 + 0.2 = 23.27 points

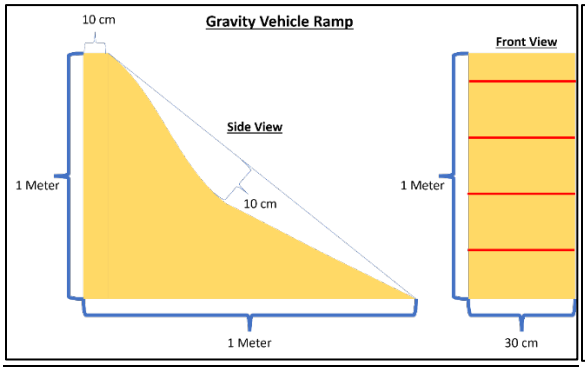
10. **Tiebreakers**

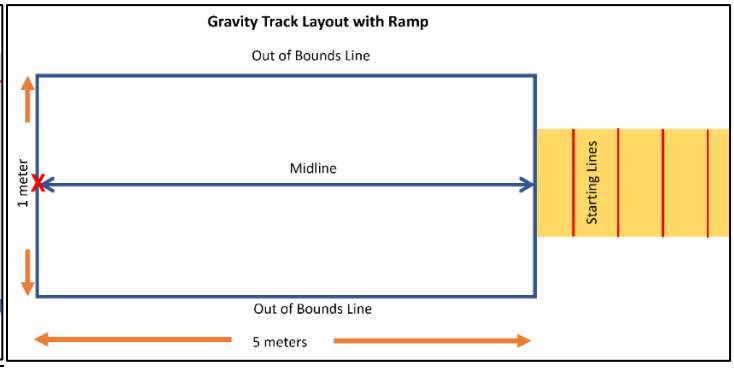
a. The smallest difference between the actual and estimated flight times
b. Correct answers on selected written assessment questions

Possible Resources

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
    i. NASA – Space Place – What is Gravity?
    ii. NASA - STEMonstrations: Friction
    iii. NASA - STEMonstrations: Simple Machines

Diagrams





Gravity Study Outline

Caution, this is a sample outline. It was Gemini AI generated and is meant as a starting point! It may or may not contain topics occurring on the written test.

1. **Simple Machines**
    a. Definition and Purpose:
    b. What is a simple machine?
    c. How do simple machines make work easier? (Explain the concept of work and how machines change the force or distance required)
        i. Types of Simple Machines:
2. **Lever:**
    a. First-class lever (e.g., seesaw)
    b. Second-class lever (e.g., wheelbarrow)
    c. Third-class lever (e.g., tweezers)
    d. Examples of levers in everyday life
3. **Pulley:**
    a. Fixed pulley
    b. Movable pulley
    c. Block and tackle system
    d. Examples of pulleys in everyday life
4. **Wheel and Axle:**
    a. How they work together
    b. Examples (e.g., doorknob, steering wheel)
5. **Inclined Plane:**

a. How it reduces the force needed to lift an object
b. Examples (e.g., ramps, stairs)

6. **Wedge:**
    a. How it splits or separates objects
    b. Examples (e.g., knife, axe)
7. **Screw:**
    a. Inclined plane wrapped around a cylinder
    b. Examples (e.g., jar lids, screws)
    c. Mechanical Advantage:
8. **How different simple machines affect mechanical advantage**
9. **Gravity and Friction on Wheeled Vehicles**
    a. Gravity:
        i. What is gravity?
        ii. How gravity affects the motion of a vehicle (e.g., downhill acceleration, uphill resistance)
10. **The role of gravity in braking**
    a. Friction:
        i. Types of friction (rolling, sliding)
        ii. How friction affects the motion of a vehicle (e.g., resistance to movement, tire wear)
        iii. The importance of tires and road surfaces in reducing friction
            1. Combined Effects:
        iv. How gravity and friction work together to influence vehicle speed and control
        v. Real-world examples (e.g., skidding, cornering)
        vi. Applications and Connections
            1. Everyday Life:
11. **Identifying simple machines in everyday objects**
12. **Understanding how gravity and friction impact daily activities (e.g., riding a bicycle, driving a car)**
13. **Technology and Engineering:**
    a. How engineers use simple machines in the design of vehicles
    b. Technological advancements in reducing friction and improving vehicle efficiency (e.g., aerodynamics, suspension systems)
14. **Assessment Preparation**
    a. Analyzing real-world scenarios involving gravity and friction
    b. Study Tips:
        i. Create flashcards
        ii. Form a study group
        iii. Review key concepts regularly
        iv. Note: This is a general outline, and you can adjust it based on the specific learning objectives and grade level of your students.

Molecular Bonding (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on how atoms and molecules bond, and using given materials, create three-dimensional models of some common compounds.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils

Safety Requirements: None

Materials provided

- Chennel
- beads
- gum drops
- toothpicks

The Competition:
The written assessment will contain 25-50 questions on how atoms and molecules bond. There is a "hands-on" building component where teams will build 3 of the listed common compounds with materials of their choosing and a mystery molecule (Clue: elemental form of an element) and explain each molecule's structure.

Atomic Structure:
Atoms, Protons, Neutrons, Electrons
Atomic and Mass Numbers
Isotopes
Chemical Symbols

Atomic Bonding:
Ionic
Covalent
Metallic

Common molecules:
carbon dioxide
methane
water
ammonia
sodium chloride
magnesium chloride
carbon monoxide
baking soda

Scoring:

a. Acronyms
   i. Competition Rubric Score (CRS) = the highest score for the molecular build for all teams
   ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
   iii. Final Score (FS)
   iv. Team Rubric Score (TRS)
   v. Team Assessment Score (TAS)

b. Final Score (FS) = Assessment Score (TAS) + Build Score (TRS). The maximum score is 100 points.
   i. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
   ii. Time Score = (TRS ÷ CBS) x 50 points; rounded to the 100th place value

c. Example
   i. (CAS) = 12. The team scores 7 on the assessment. (TAS) for the team= (7 ÷ 12) x 50 = 29.17 points
   ii. (CRS) = 10. The team's build score is 8. (TRS) for the team= (8 ÷ 10) x 50 = 40 points
   iii. (FS) = 29.17 + 40 = 69.17 points

Tiebreakers

a. Correct answers on selected written assessment questions as chosen by the test writer or Event Supervisor
b. Best Rubric Score

Molecular Bonding Build Rubric

Criterion	Beginning (1)	Developing (2)	Exceeding Expectations (3)
Accuracy	The model has significant inaccuracies in structure or composition. Key elements are missing or incorrect.	The model is mostly accurate, with minor errors in structure or composition. Most key elements are present.	The model is completely accurate, with all elements correctly represented and detailed.
Creativity	The model shows little creativity. It follows a basic design with minimal effort to enhance presentation.	The model shows some creativity. There are a few unique elements or thoughtful design choices.	The model is highly creative, with innovative design and presentation that enhances understanding.
Explanation	The explanation is unclear or incomplete. Key concepts about the compounds are missing or incorrect.	The explanation is mostly clear, with minor gaps or errors. Most key concepts are covered.	The explanation is clear, thorough, and accurate. All key concepts are well-explained and insightful.
Neatness	The model is poorly constructed, with visible flaws or messiness that detract from its appearance.	The model is mostly neat, with minor imperfections. It is generally well-constructed.	The model is exceptionally neat and well-constructed, with attention to detail and a polished appearance.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

- Chemical Bonding - Chemistry for Kids
- Chemical bonds | Chemistry of life | Biology (article)

Study Guide: Chemical Bonding

This study guide provides a basic overview of chemical bonding

1. What are Atoms?
    a. Basic Building Blocks: Atoms are the smallest units of matter that retain the properties of an element.
    b. Structure:
        i. Nucleus: Contains protons (positive charge) and neutrons (no charge).
        ii. Electrons: Tiny particles with a negative charge that orbit the nucleus in shells or energy levels.
2. What are Elements?
    a. Pure Substances: Elements are made up of only one type of atom.
    b. Examples: Hydrogen (H), Oxygen (O), Carbon (C), Gold (Au)
3. What are Compounds?
    a. Two or More Elements Combined: Compounds are substances formed when two or more different elements chemically combine.
    b. Examples: Water (H_2O), Salt (NaCl), Carbon Dioxide (CO_2)
4. How do Atoms Bond?
    a. To become stable: Atoms tend to gain, lose, or share electrons to achieve a stable electron configuration (usually 8 electrons in their outer shell).
5. Types of Bonds:
    a. Covalent Bonds:
        i. Atoms share electrons to fill their outer shells.
        ii. Example: Water (H_2O) - Hydrogen atoms share electrons with the Oxygen atom.
        iii. Molecules: Substances formed by covalent bonds are called molecules.
    b. Ionic Bonds:
        i. One atom loses electrons, becoming positively charged (ion).
        ii. Another atom gains electrons, becoming negatively charged (ion).
        iii. Oppositely charged ions attract each other.
        iv. Example: Salt (NaCl) - Sodium loses an electron, Chlorine gains an electron.
6. Key Concepts
    a. Electron Configuration: Understand how electrons are arranged around the nucleus.
    b. Stability: Recognize that atoms strive for stability by gaining, losing, or sharing electrons.
    c. Types of Bonds: Differentiate between covalent and ionic bonds.
    d. Examples: Be able to identify examples of compounds formed by covalent and ionic bonds.
7. Practice Questions:
    a. What are the main parts of an atom?
    b. How do atoms achieve stability?

c. What is the difference between a covalent bond and an ionic bond?

d. Give an example of a compound formed by a covalent bond.

e. Give an example of a compound formed by an ionic bond.

8. Remember to:
    a. Review your notes.
    b. Ask your teacher any questions you have.
    c. Get a good night's sleep before the competition.

Good Luck!

Pentathlon (Coach Scheduled Testing - 45 Minutes)

Description: The group will run a timed relay race. Each team member will complete individual physical and academic challenges. The academic challenges will come from the 2018 Virginia Department of Education Science Standards of Learning; Standard 6.2-Solar System, Standard 6.4-Energy, Standard 6.5-Matter, Standard 6.6-Water, Standard 6.9-Environment. After the individual challenges, the team will collaborate on a sixth challenge.

Participants per assigned Team Number: 5

- If your school has 1 team you will send 5 students
- If your school has 2 teams you will send 5 students per team number; team numbers may not intermix
- If your school has 3 teams you will send 5 students per team number; team numbers may not intermix

Safety Requirements: closed-toe shoes

Teams need to bring: All materials are provided

The Competition:

1. This is a 5-person relay event with physical and academic challenges. All teams will have the same challenges
    a. Each team member will have a maximum of 2 minutes to complete 1 physical activity and 1 academic challenge
        i. If a team member cannot complete their tasks on time, they must tag in the next member
        ii. Students who may not be able to complete the physical challenge due to some physical limitation may designate another team member to complete the challenge for them, but they must complete the academic challenge on their own
        iii. Teams may send less than 5 students but will still have to complete all physical and academic tasks

2. Each team member will answer up to 5 academic questions based on the 2018 Virginia Science Standards of Learning before, during or after their physical challenge
    a. Standard 6.2-Solar System
    b. Standard 6.4-Energy
    c. Standard 6.5-Matter
    d. Standard 6.6-Water
    e. Standard 6.9-Envronment

3. The physical activities will include, pushups, burpees, crunches, jump squats and jumping rope 20 times without a miss.
    a. Each activity will pair with academic questions
        i. 15 Pushups-Standard 6.2
        ii. 15 Burpees-Standard 6.4
        iii. 15 Crunches-Standard 6.5
        iv. 15 Jump Squats-Standard 6.6
        v. Jump Rope-Standard 6.9

4. A combined team challenge will occur after the individual tasks
    a. All members must participate in this challenge
    b. This challenge has a 4-minute time limit

5. This event may have multiple teams participating at different times with one Event Supervisor timing one team.
    a. Timing will stop when the team completes all physical and academic challenges
    b. Teams may not revisit challenges they could not finish in the allotted 2-minute time limit

6. Scoring:
    a. Acronyms
        i. Competition Relay Score (CRS) = the fastest relay time for all teams
        ii. Competition Academic Score (CAS) = the highest academic challenge score for all teams
        iii. Final Score (FS)
        iv. Team Relay Score (TRS)
        v. Team Academic Score (TAS)
    b. Final Score (FS) = (TAS) + (TRS). The maximum score is 100 points.
        i. Academic Score = (TAS ÷ CAS); rounded to the 100th place value
        ii. Distance Score = (CRS ÷ TRS); rounded to the 100th place value
    c. Example
        i. (CAS) = 11. The team scores 4 on the academic challenge. (TAS) for the team= (4 ÷ 11) x50 = 18.18 points
        ii. (CRS) = 346 sec. The team's relay time is 521sec. (TRS) for the team= (346 ÷ 521) x50 = 33.21 points
        iii. (FS) = 18.18 + 33.21 = 51.39 points

7. **Tiebreaker:**
    a. The tiebreaker will be the number of correct answers to select academic challenge questions

Possible resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
    i. Healthline: 8 Calisthenics Exercises for a Basic Workout
    ii. NASA Train Like an Astronaut

2018 Virginia Science Standards of Learning:

6.2	The student will investigate and understand that the solar system is organized and the various bodies in the solar system interact. Key ideas include a) matter is distributed throughout the solar system; b) planets have different sizes and orbit at different distances from the sun; c) gravity contributes to orbital motion; and d) the understanding of the solar system has developed over time.
6.4	The student will investigate and understand that there are basic sources of energy and that energy can be transformed. Key ideas include a) the sun is important in the formation of most energy sources on Earth; b) Earth's energy budget relates to living systems and Earth's processes; c) radiation, conduction, and convection distribute energy; and d) energy transformations are important in energy usage.

6.5	The student will investigate and understand that all matter is composed of atoms. Key ideas include a) atoms consist of particles, including electrons, protons, and neutrons; b) atoms of a particular element are similar but differ from atoms of other elements; c) elements may be represented by chemical symbols; d) two or more atoms interact to form new substances, which are held together by electrical forces (bonds); e) compounds may be represented by chemical formulas; f) chemical equations can be used to model chemical changes; and g) a few elements comprise the largest portion of the solid Earth, living matter, the oceans, and the atmosphere.
6.6	The student will investigate and understand that water has unique physical properties and has a role in the natural and human-made environment. Key ideas include a) water is referred to as the universal solvent; b) water has specific properties; c) thermal energy has a role in phase changes; d) water has a role in weathering; e) large bodies of water moderate climate; and f) water is important for agriculture, power generation, and public health.
6.9	The student will investigate and understand that humans impact the environment and individuals can influence public policy decisions related to energy and the environment. Key ideas include a) natural resources are important to protect and maintain; b) renewable and nonrenewable resources can be managed; c) major health and safety issues are associated with air and water quality; d) major health and safety issues are related to different forms of energy; e) preventive measures can protect land-use and reduce environmental hazards; and f) there are cost/benefit tradeoffs in conservation policies.

Ping Pong Parachute (Coach Scheduled Testing - 45 Minutes)

Description: Teams will design and build a paper rocket to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time. Every effort will be made to hold this event inside with a high ceiling. If a suitable space is not available, the event will run outdoors if the weather cooperates. **This event has a building component and a written assessment on the basic principles of rocketry.**

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

- Writing Utensils
- a ruler or straight edge
- one pair of scissors
- 1 – team design log

Materials Provided at Event:

- Two sheets of 25 cm x 28 cm tissue paper
- Four ≈12.5 by ≈20 cm index cards
- Two 20 lb. weight papers ≈ 21 cm x 30 cm
- 50 cm of masking tape
- 1 meter of 40 wt. polyester thread
- 1 standard 40 mm Ping Pong ball
- A Stomp Rocket launch system
- A launch system practice dowel

The Competition:

1. **Written Test:** The team members will have an assessment on the basic principles of rocketry. The assessment will take place concurrently with the building phase.
    a. **As a part of the written test teams will estimate the time their ping pong ball will stay aloft.**

2. **Building**
    a. Teams will have 30 minutes to build their rocket and parachute system
    b. Using the launch system practice dowel as a guide, teams will create a paper rocket of any shape and form, that will carry a parachute payload system
        i. The payload system consists of the ping pong ball attached to a parachute
    c. Teams may use all or a portion of the provided materials to create the rocket and/or the payload system
    d. Participants without eye protection will not compete
    e. Teams that continue building or improving their design after 30 minutes will receive a tier violation

3. **Design Log:**
    a. Teams must present a design log of at least 3 rocket designs
        i. The design log must contain metric measurements of all the components the team intends to build
    b. This design log will count for up to 15 points of the team score
        i. Each design will earn 5 points
    c. Teams without a design log receive a tier violation

4. **Launching:**
    a. All energy imparted to the rocket/parachute payload system will originate from a team member stomping on the launch system air bladder
    b. When called to launch, teams will load their rocket onto the launcher
    c. The Event Supervisor will make sure timers are ready and then signal a team member to make a loud announcement of, "3, 2, 1, LAUNCH!"
    d. The team member will proceed to launch the rocket by jumping of the provided air bladder
    e. Timing begins when the team member lands on the air bladder and stops when the parachute payload system lands
        i. The parachute payload system must separate from the rocket. If the parachute payload system does not separate from the rocket, the team receives a tier violation
    f. If a rocket fails to separate from the launcher because of a problem with the supplied launcher then the launch never occurred, and the launch will be restarted with a different launcher
        i. This will not occur if the Event Supervisor deems that the flaw is with the team build and not the launcher
    g. The Event Supervisor will record the time from all timers for the launch and average them to the 1/100 of a second

5. **Scoring:**
    a. The team with the highest **Final Score** will place above all other teams
    b. Rockets and/or parachute payload systems deemed unsafe by the Event Supervisor will not launch and will receive a tier violation
    c. Scoring Acronyms
        i. Competition Flight Score (CFS) = the longest flight time for all teams
        ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
        iii. Final Score (FS)
        iv. Team Time Score (TTS)

v. Team Assessment Score (TAS)
vi. Design Log Score (DS)
vii. Final Score (FS) = Assessment Score (TAS) + Time Score (TTS) + Design Log Score (DS). The maximum score is 100 points.
    1. Assessment score = (TAS ÷ CAS) x 40 points; rounded to the 1/100 place value
    2. Time Score = (TTS ÷ CFS) x 45 points; rounded to the 1/100 place value
    3. Design Log Score = (DS ÷ 3) x 15 points; rounded to the 1/100 place value

d. Example

i. (CAS) highest for all teams = 15. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 15) x 40 = 24 points
ii. (CFS) highest for all teams = 3.56 seconds. The team's flight time is 1.45. (TTS) for the team= (1.45 ÷ 3.56) x 45 = 18.3 points
iii. (DS) = 10 points for 2 designs
iv. (FS) = 30 + 20.4 + 10 = 60.4 points

6. Tiebreakers:

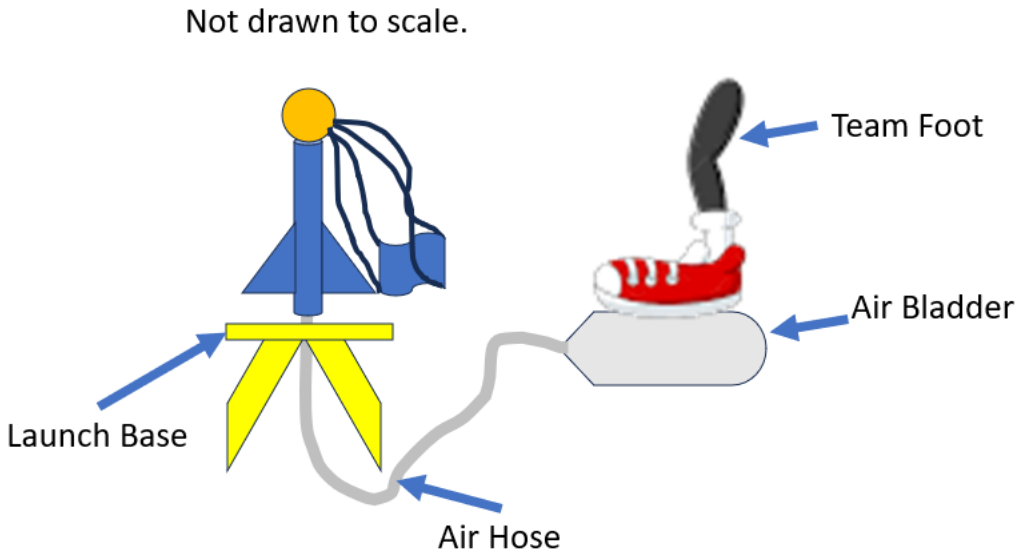
a. Closest estimate to the landing of the parachute payload system
b. Score on the written test
c. Event Supervisor's chosen questions from the written test

7. **Tiers:** The Event Supervisor will apply the highest tier number if more than one is applicable:
    a. A tier violation is a penalty to a team for not following the build guidelines or the spirit of the problem as judged by the Event Supervisor. Teams placed in tiers 2 or 3 will receive scores reduced by 50 and 100 points respectively.
        i. Tier 1. The team rocket and payload system meet all the building requirements, and the team follows the Spirit of the Problem guidelines
        ii. Tier 2. The team rocket and/or payload system are deemed to have a construction or time fault violations and the team follows the Spirit of the Problem guidelines
        iii. Tier 3. The team did not follow the Spirit of the Problem guidelines
    b. Possible construction or time violations
        i. The payload system does not separate from the rocket in flight
        ii. A part of the rocket or payload system falls off during launch or flight
        iii. The team continues to build or improve after the 30-minute time

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
    i. NASA - Stomp Rockets - (This site includes directions for building a stomp rocket launcher)
    ii. NASA - What is a rocket?
    iii. Rockets | NASA Space Place – NASA Science for Kids
    iv. Why Do Rockets Have Fins?

Competition Diagram



Ping Pong Parachute Study Outline

Caution, this is a sample outline. It was Gemini AI generated and is meant as a starting point! It may or may not contain topics occurring on the written test.

1. Introduction to Rocketry
    a. What is a Rocket?
        i. Definition: A vehicle that obtains thrust by the reaction to the ejection of mass (propellant).
    b. Key Components:
        i. Nozzle
        ii. Combustion Chamber
        iii. Propellant Tank
        iv. Guidance System
    c. History of Rocketry
        i. Brief Overview: From early fireworks to space exploration.
        ii. Key Figures: (Optional) Mention key figures like Konstantin Tsiolkovsky, Robert Goddard, Wernher von Braun.
2. Basic Principles of Rocketry
    a. Newton's Laws of Motion
        i. Newton's Third Law: For every action, there is an equal and opposite reaction. (Explain how this applies to rocket propulsion).
        ii. Conservation of Momentum: Explain how the rocket gains momentum by expelling mass.
    b. Types of Rocket Propulsion
        i. Chemical Rockets:
        ii. Solid Propellant Rockets
        iii. Liquid Propellant Rockets
        iv. Other Propulsion Methods: (Briefly mention other methods like ion propulsion, nuclear propulsion - if applicable for middle school level)
    c. Rocket Stages
        i. Explain the concept of multi-stage rockets.
        ii. Advantages of multi-stage rockets: Increased efficiency and payload capacity.

3. Rocket Flight
    a. Launch and Ascent
        i. Stages of a typical rocket launch: Liftoff, ascent, staging.
        ii. Factors affecting rocket trajectory: Gravity, air resistance, thrust.
    b. Orbital Mechanics
        i. Basic concepts of orbits: Circular orbits, elliptical orbits.

    (Optional: Briefly introduce concepts like escape velocity and gravitational assist).
4. Applications of Rocketry
    a. Space Exploration:
        i. Satellites (communication, weather, Earth observation)
        ii. Space probes (planetary exploration)
        iii. Human spaceflight
        iv. Other Applications:
        v. Military applications (missiles)
        vi. Commercial applications (launching satellites for telecommunications)
5. Safety and Ethics
    a. Safety Considerations:
        i. Handling propellants safely.
        ii. Launch site safety procedures.
    b. Ethical Considerations:
        i. Environmental impact of rocket launches.
        ii. Space debris.
        iii. The responsible use of space technology.
6. Activities
    a. Model Rocketry:
    b. Basic components of a model rocket.
    c. Safety guidelines for launching model rockets.
7. Note:
    a. Use visuals: Incorporate diagrams, pictures, and videos to enhance your understanding.
    b. Hands-on activities: Include hands-on activities like building simple rockets

Propeller Car (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build a wheeled vehicle that uses power provided by rubber bands and propeller to travel across a specified distance in the fastest time. There is a written assessment on the uses for propellers on travel. The object is to build the fastest and straightest traveling car while scoring the most points on the assessment.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

- Writing Utensils
- a ruler or straight edge
- one pair of scissors
- 1 – team design log
- Impact Safety Glasses

Materials Provided:

- 4 ≈ 4 cm plastic wheels
- 2 ≈ 20 cm paper drinking straws
- 2 ≈7.5 cm cooking skewers
- 4 ≈ 15 cm craft sticks
- 1 ≈ 15cm Propeller
- 1 ≈ 15 cm x 5 cm x 5 cm mailing box
- 1 ≈13 cm by 7.5 cm piece of cardboard
- 1 meter of 2.54 cm masking tape
- 2 Rubber bands – student may choose from an assortment of sizes #64, #33, and #19

The Competition:

1. **Written Test:** The team members will take a test on the use of propellers in travel. The test will take place simultaneously during the construction of the team car.
    a. *As a part of the written test the team will estimate the time needed for their vehicle to travel the 5 meters.*

2. **Construction Phase:**
    a. Teams will have 30 minutes to build and test their car in the competition area
    b. Teams may cut their materials to any size they deem appropriate, except for the craft sticks which must remain whole
        i. Teams may use as much or as little of their materials to build their propeller car.
        ii. A request for additional materials is a tier violation. This means that the team may still participate but will be placed below all teams that do not violate this rule
    c. Teams may have 2 untimed practice runs to test their car within the 30 minutes build time with permission of the Event Supervisor
        i. 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 tier violation
        ii. Practice runs will not occur after the 30-minute build time

3. **Design Log:**
    a. Teams must present a design log for at most 3 car designs
        v. Each design will earn 5 points and be used to calculate the final team score
        vi. The design log must contain metric measurements of all the components the team intends to build
    b. Teams without a design log receive a tier violation
    c. Teams may elect not to use one of their designs at the competition

4. **The Track:**
    a. It will be 5 meters long on a relatively smooth, hard surface
    b. It will have a start and end line, a center line, a width of one meter

5. **Official Testing:**
    a. Each team will have one officially scored run
    b. The team will prepare their propeller and hold their car anywhere behind the start line
    c. The team must state that they are ready to launch and must wait for the Event Supervisor to acknowledge they are ready
    d. At this signal a team member will make a loud announcement of, “3, 2, 1, LAUNCH!” and release the car
    e. Teams that push their car at any time will receive a tier violation
    f. If a car does not reach the end line, the team may wind their propeller again without penalty starting from where the car stopped

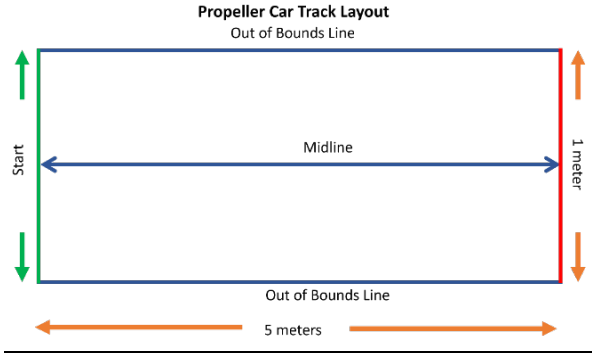
6. **Event Supervisor Records:**
    a. The estimated time given by the team
    b. Number of incorrect answers on the written assessment
    c. Time for the team car to travel between the start and end lines to the 1/100 second
    d. The distance from the mid-point line to where the car finishes crossing the end line to the nearest millimeter
    e. The number of correctly labeled car designs

7. **Scoring:**
    a. Acronyms
        i. Competition Assessment Score (CAS) = the highest assessment score for all teams
        ii. Competition Time Score (CTS) = the shortest timing for all teams
        iii. Final Score (FS)
        iv. Team Time Score (TTS)
        v. Team Assessment Score (TAS)
        vi. Log Score (LS)
    b. Final Score (FS) = Assessment Score (TAS) + Time Score (TTS) + Log Score (LS) The maximum score is 100 points.
        i. Assessment score = (TAS ÷ CAS) x 0.45; rounded to the 100th place value; maximum 45 points
        ii. Time Score = (CTS ÷ TTS) x 0.45; rounded to the 100th place value; maximum 45 points
        iii. Log Score = (LS ÷ 3) x 0.10; rounded to the 100th place value; maximum 10 points
    c. Example
        i. (CAS) = 15. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 15) x 50 = 30 points
        ii. (CTS) = 3.56 seconds. The team's time is 1.45. (TTS) for the team= (1.45 ÷ 3.56) x 50 = 20.36 points
        iii. (LS) = Team has 1 design log. (LS) = (1 ÷ 3) x 10 = 3.33 points
        iv. (FS) = 30 + 20.36 + 3.33 = 53.69 points

8. **Tiebreakers in order:**
    a. The team with the closest estimate to their travel time
    b. The team closest to the midline when passing the end line
    c. The better score on the written test
    d. Select questions on the test

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
    - Young Engineers: How to make a propeller powered car - Engineering project for kids
    - Propeller-Powered Car Project for Kids



Study Guide/Outline: Propellers and Travel

1. Introduction
    a. What is a propeller?
        i. Basic definition and components (blades, hub)
        ii. How does a propeller work? (Explain lift and thrust)
    b. The importance of propellers in transportation
2. Propellers in Different Modes of Travel
    a. Airplanes:
        i. Types of airplane propellers (fixed-pitch, variable-pitch)
        ii. How propellers help airplanes take off, fly, and land
        iii. Advantages and disadvantages of propeller-driven airplanes compared to jet airplanes
    b. Boats and Ships:
        i. Types of marine propellers (screw propellers, outboard motors)
        ii. How propellers help boats and ships move through water
        iii. Different types of boats that use propellers (speedboats, cargo ships, submarines)
    c. Other Uses:
        iii. Helicopters (rotors are a type of propeller)
        iv. Drones (propellers for lift and control)
        v. Wind turbines (use propellers to generate electricity)
3. Historical Development of Propellers
    a. Early forms of propulsion (e.g., sails, oars)
    b. Key inventions and inventors in propeller development (briefly mention key figures)
    c. How propeller technology has evolved over time (materials, design improvements)
4. Safety and Environmental Considerations
    a. Propeller safety (keeping hands and feet away, potential hazards)
    b. Noise pollution from propellers
    c. Environmental impact of propeller-driven vehicles (e.g., emissions)
5. Future of Propeller Technology
    a. New materials and designs for more efficient propellers
    b. Role of propellers in sustainable transportation (e.g., electric aircraft, hybrid propulsion)
6. Tips for Studying:
    a. Read the study guide carefully and take notes.
    b. Use diagrams and pictures to help visualize how propellers work.
    c. Research and learn more about specific types of propellers and their applications.
    d. Practice answering review questions.
    e. Work with a study group to discuss and review the material.

Sail Car (Coach Scheduled Testing - 45 Minutes)

Description: Teams will design, build, and race a sail-powered model using wind as their only source of energy, to travel a distance 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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

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

Materials Provided:

- 4 ≈ 4 cm plastic wheels
- 6 ≈ 20 cm paper drinking straws
- 2 ≈7.5 cm cooking skewers
- 4 ≈ 15 cm craft sticks
- 1 ≈ 8.5 X 11-inch tissue paper
- 1 ≈ 8.5 X 11-inch 60–90-pound card stock paper
- 1 ≈13 cm by 7.5 cm piece of cardboard
- 1 meter of 2.54 cm masking tape
- 10 grams of plasticine

The Competition:

1. **Written Test:** 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.
    a. *As a part of the written test the team will estimate the time needed for their vehicle to travel the 3 meters.*

2. **Construction Phase:**
    a. Teams will have 30 minutes to build and test their car in the competition area
    b. Teams may cut their materials to any size they deem appropriate, except for the craft sticks which must remain whole
        i. Teams may use as much or as little of their materials to build their car.
        ii. A request for additional materials is a tier violation. This means that the team may still participate but will be placed below all teams that do not violate this rule
    c. Teams may have 2 untimed practice runs to test their car within the 30 minutes build time with permission of the Event Supervisor
        i. 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 tier violation
        ii. Practice runs will not occur after the 30-minute build time

3. **The Track:**
    a. It will be 3 meters long on a relatively smooth, hard surface
    b. It will have a start and end line, a center line, a width of one meter

4. **Official Testing:**
    a. Each team will have one officially scored run
    b. The team will prepare and hold their car anywhere behind the start line
    c. 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
    d. At this signal a team member will make a loud announcement of, "3, 2, 1, LAUNCH!" and turn the fan on
    e. Teams that push their car at any time will receive a tier violation

5. **Event Supervisor Records:**
    a. The estimated time given by the team
    b. Number of incorrect answers on the written assessment
    c. Time for the team car to travel between the start and end lines to the 1/100 second
    d. The distance from the mid-point line to where the car finishes crossing the end line to the nearest millimeter

6. **Scoring:**
    a. Acronyms
        i. Competition Assessment Score (CAS) = the highest assessment score for all teams
        ii. Team Assessment Score (TAS) = the team assessment score
        iii. Competition Time Score (CTS) = the shortest timing for all teams
        iv. Team Time Score (TTS) = the time for the team car to travel the length of the track
        v. Final Score (FS)
        vi. Assessment Score (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
        vii. Time Score (CTS ÷ TTS) x 50; rounded to the 100th place value; maximum 50 points
    b. Example

i. (CAS) = 15. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 15) x 50 = 30 points
ii. (CTS) = 3.56 seconds. The team's time is 1.45. (TTS) for the team= (1.45 ÷ 3.56) x 50 = 20.36 points
iii. (FS) = 30 + 20.36 = 50.36 points

c. Out of Bounds Penalty
   i. Any team having their car cross the out of bounds lines will receive a final score penalty equal to 1 point for each centimeter from the junction of the finish line and the out of bounds line as witnessed by the Event Supervisor
   ii. Any team having car veer of the track and become entangled or stopped by an obstacle will receive a tier violation

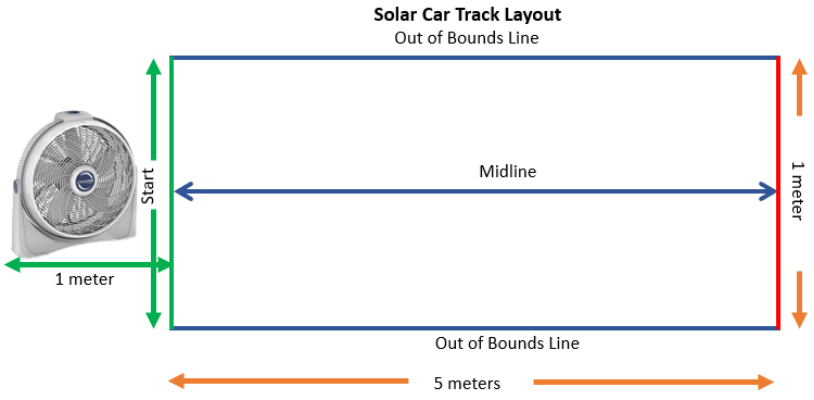
7. **Tiebreakers in order:**
   a. The team with the closest estimate to their travel time
   b. The team closest to the midline when passing the end line
   c. The better score on the written test
   d. Select questions on the test

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**

- NASA - What Is Aerodynamics?
- Kid Wind – Sail Cars Activity
- PBS Kids – Wild Wind (.pdf format)

Solar Car Track



Wind, Angles, and Aerodynamics Study Guide

I. Understanding Wind

- What is Wind?
  - Moving air.
  - Caused by differences in air pressure.

    - Can vary in speed and direction.
- Measuring Wind:
    - Wind vane: Measures wind direction.
    - Anemometer: Measures wind speed.
    - Beaufort Wind Scale: A system for estimating wind force based on observed effects.

II. Angles in Aerodynamics

- Angle of Attack:
    - The angle between the chord of an airfoil (like an airplane wing) and the direction of the oncoming air.
    - Critical for generating lift.
- Lift and Drag:
    - Lift: The upward force that allows an object to fly.
    - Drag: The force that resists the motion of an object through the air.
- How Angle of Attack Affects Lift and Drag:
    - Small angles of attack: Increase lift, decrease drag.
    - Large angles of attack: Can cause stall (sudden loss of lift).

III. Aerodynamics

- Four Forces of Flight:
    - Lift
    - Drag
    - Thrust
    - Weight
- How Airfoils Work:
    - The curved shape of an airfoil causes air to travel faster over the top surface.
    - This creates a lower pressure above the wing, resulting in lift.
- Streamlining:
    - The process of designing objects to reduce air resistance.
    - Examples: Airplane wings, car bodies.

IV. Real-World Applications

- Flying: How airplanes, birds, and insects fly.
- Wind Power: How wind turbines generate electricity.
- Sailing: How sails use wind to propel a boat.
- Sports: How wind affects sports like golf, sailing, and cycling.

Study Tips

- Draw diagrams: Visualize angles of attack, lift, and drag.
- Do experiments: Make sails, experimenting with different wing shapes and angles.
- Watch videos: Find videos that explain aerodynamic concepts in a clear and engaging way.
- Relate to real-life: Observe how wind affects objects in your everyday life.

This study guide provides a basic overview. Good luck with your assessment!

Shock Value (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on direct current circuits and basic electricity and will use breadboards, wires, a battery, a resister and an LED to create a simple circuit.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams Must Bring:

- Pen/Pencil
- Four function calculator

Competition:

Both parts will run concurrently during this event.

- Part 1: Students will take a written test to answer topic questions on Electricity: Basic electricity concepts, conductors & insulators, electron flow, series and parallel circuits, simple Ohm's Law calculations.

- Part 2: Students will build a simple serial circuit using the materials provided.
  - 1-Mini LED
  - 1-SYB-170 Mini Breadboard Small Plates
  - 4-40pin Male to Male ribbon wires
  - 1-AAA Battery Holder Single 1x 1.5V
  - 1-220 Ohm resistor

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the event leader prior to the competition.
- Build score calculations

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
  - **Lessons In Electric Circuits**

- **The Physics Classroom Tutorial**
- **Khan Academy Electricity and Magnetism**
- **PhysicsClassroom Electricity and Magnetism**
- **SparkFun Electronics**

Electricity Study Guide

Basic Electricity Concepts

- Static Electricity: The buildup of an electrical charge on the surface of an object.
- Electric Current: The flow of electric charge.
- Voltage: The electrical potential energy difference between two points.
- Resistance: The opposition to the flow of electric current.
- Ohm's Law: The relationship between voltage, current, and resistance.

Conductors and Insulators

- Conductors: Materials that allow electric current to flow easily.
    - Examples: metals, water, the human body.
- Insulators: Materials that do not allow electric current to flow easily.
    - Examples: rubber, plastic, glass.

Electron Flow

- Electrons: Negatively charged particles that flow through a conductor to create an electric current.
- Conventional Current: The flow of positive charge, which is the opposite direction of electron flow.

Series and Parallel Circuits

- Series Circuit: A circuit with only one path for the current to flow.
    - If one component fails, the entire circuit is broken.
    - The total resistance of the circuit is the sum of the individual resistances.
- Parallel Circuit: A circuit with multiple paths for the current to flow.
    - If one component fails, the other components can still function.
    - The total resistance of the circuit is less than the resistance of any individual resistor.

Ohm's Law Calculations

- Ohm's Law Formula: V = IR, where V is voltage, I is current, and R is resistance.
- Calculating Voltage: V = IR
- Calculating Current: I = V/R
- Calculating Resistance: R = V/I

Additional Tips

- Practice, practice, practice: The more you practice, the better you will understand the concepts.
- Use diagrams: Diagrams can help you visualize the concepts and make them easier to understand.
- Take breaks: Don't try to cram everything in at once. Take breaks to rest and come back to the material later.
- Ask for help: If you are struggling with a concept, don't be afraid to ask for help from your teacher or a tutor.

Electricity Test Practice Questions

1. What is the difference between a conductor and an insulator?
2. What is the relationship between voltage, current, and resistance?
3. What is the difference between a series circuit and a parallel circuit?[1]
4. How can you calculate the total resistance of a series circuit?
5. How can you calculate the total resistance of a parallel circuit?
6. What is Ohm's Law?
7. How can you use Ohm's Law to calculate voltage, current, and resistance?

Electricity Test Answer Key

1. A conductor is a material that allows electric current to flow easily, while an insulator is a material that does not allow electric current to flow easily.

2. Voltage, current, and resistance are related by Ohm's Law, which states that V = IR.
3. A series circuit has only one path for the current to flow, while a parallel circuit has multiple paths for the current to flow.
4. The total resistance of a series circuit is the sum of the individual resistances.
5. The total resistance of a parallel circuit is less than the resistance of any individual resistor.
6. Ohm's Law is the relationship between voltage, current, and resistance.
7. You can use Ohm's Law to calculate voltage, current, and resistance by using the formula V = IR.

Remember: The best way to prepare for your electricity test is to practice and understand the concepts. Use this study guide as a resource to help you review the material and identify any areas where you need additional help. Good luck!

Solar System (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on the eight planets and their main identifying features, their moons, and any NASA missions that were sent to determine their habitability.

Participants per assigned Team Number:

- 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

Spirit of the Problem:

➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).

➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils

Safety Requirements: None

The Competition:

This written assessment will contain 25-50 questions on the eight planets and their main identifying features, their moons, and any NASA missions that were sent to determine their habitability. The assessment may include topic questions based on the following planet classifications and characteristics information:

- Planet relative distance from the sun
- Planet relative size
- Planet temperature
- Planet composition and density
- Planet length of day
- Planet length of year
- Planet number of and composition of moons
- Planet atmospheres
- NASA satellite and surface visits by spacecraft
- Understand the astronomical definitions for the terms: zenith, horizon, celestial meridian, celestial poles, celestial equator, and ecliptic as they help locate the planets in the night sky on the day of the competition.

Scoring:

- Points will be awarded for each correct response.
- Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer prior to the competition.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

i. NASA: About the Planets
ii. The Nine Planets

Astronomy Study Guide: Planets and the Night Sky

I. The Eight Planets: Key Features

A. Terrestrial (Rocky) Planets

1. Mercury:
   - Closest to the Sun.
   - Smallest planet.
   - Extreme temperature variations (day very hot, night very cold).
   - Thin atmosphere (exosphere).
   - Heavily cratered surface.
   - Length of day: About 59 Earth days.
   - Length of year: About 88 Earth days.
   - No moons.
   - NASA Missions: Messenger, BepiColombo (joint ESA/JAXA).
2. Venus:
   - "Earth's sister planet" (similar size).
   - Hottest planet (thick CO2 atmosphere creates a greenhouse effect).
   - Rotates slowly in the opposite direction (retrograde rotation).
   - Length of day: About 243 Earth days.
   - Length of year: About 225 Earth days.
   - No moons.
   - NASA Missions: Magellan, Pioneer Venus.
3. Earth:
   - Only known planet to support life.
   - Liquid water on the surface.
   - Nitrogen and oxygen-rich atmosphere.
   - Length of day: About 24 hours.
   - Length of year: 365.25 days.
   - One moon (Luna).
4. Mars:
   - "Red Planet" (iron oxide in the soil).
   - Thin atmosphere.
   - Polar ice caps.
   - Evidence of past liquid water.
   - Length of day: Slightly longer than Earth's.
   - Length of year: About 687 Earth days.
   - Two moons (Phobos, Deimos).
   - NASA Missions: Mars rovers (Curiosity, Perseverance), Mars Reconnaissance Orbiter.

B. Gas Giant Planets

5. Jupiter:
    - Largest planet.
    - Great Red Spot (giant storm).
    - Strong magnetic field.
    - Many moons (including Galilean moons: Io, Europa, Ganymede, Callisto).
    - Length of day: About 10 Earth hours.
    - Length of year: About 12 Earth years.
    - Composition: Mostly hydrogen and helium.
    - NASA Missions: Voyager, Galileo, Juno.
6. Saturn:
    - Prominent ring system (ice and rock).
    - Titan (largest moon, with a thick atmosphere).
    - Length of day: About 10.7 Earth hours.
    - Length of year: About 29 Earth years.
    - Composition: Mostly hydrogen and helium.
    - NASA Missions: Voyager, Cassini-Huygens.
7. Uranus:
    - Rotates on its side.
    - Blue-green color (methane in the atmosphere).
    - Ring system.
    - Length of day: About 17 Earth hours.
    - Length of year: About 84 Earth years.
    - Composition: Ices, hydrogen, and helium.
    - NASA Missions: Voyager 2.
8. Neptune:
    - Blue color (methane in the atmosphere).
    - Strong winds.
    - Triton (largest moon, with retrograde orbit).
    - Length of day: About 16 Earth hours.
    - Length of year: About 165 Earth years.
    - Composition: Ices, hydrogen, and helium.
    - NASA Missions: Voyager 2.

II. Astronomical Terms

- Zenith: The point directly overhead.
- Horizon: The line where the sky and Earth appear to meet.
- Celestial Meridian: An imaginary line passing from the north celestial pole through the zenith to the south celestial pole.
- Celestial Poles: The points in the sky directly above Earth's north and south poles.
- Celestial Equator: An imaginary circle in the sky directly above Earth's equator.
- Ecliptic: The apparent path of the Sun through the sky over a year.

III. NASA Missions and Habitability

- Focus on missions that searched for evidence of past or present water, and conditions that could support life.

- Key missions:
    - Mars rovers (Spirit, Opportunity, Curiosity, Perseverance).
    - Galileo (Jupiter and its moons, especially Europa).
    - Cassini-Huygens (Saturn and its moons, especially Titan and Enceladus).

IV. Study Tips

- Use visual aids (images, diagrams).
- Create flashcards for planet facts.
- Draw diagrams of the solar system, labeling distances and sizes.
- Practice identifying planets in the night sky using star charts or astronomy apps.
- Practice defining and drawing the astronomical terms.

By studying these points, you should be well prepared to answer the questions on the planets and astronomical terms.

Sounds of Music (On the team schedule - 30 minutes)

Description: Teams will answer questions on the physics of sound and using the provided materials create a musical note of their choice between E5 and A3.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams Must Bring:

- Pen/Pencil
- Teams may not bring any notes, calculators, books, for any portion of this event
- Teams will not bring pre-made devices

Materials provided

- 1- round microwavable 621 ml stoneware bowl: width 13 cm outside to outside dimeter; height 6.3 cm rim to table
- A wooden spatula
- A metal spoon
- An elementary music class xylophone mallet
- 1 to 2 cup Standard/Metric measuring cup
- 10 ml Pipette and 10 ml Syringe
- Water

The competition: This event will have a written test and a station for the teams to produce 2 musical notes. These will run concurrently. When the team is not producing their notes, they are taking their test and vice versa.

Part 1: Knowledge

The written test will consist of 25-40 questions based on the following topics and vocabulary.

- Principles of Acoustics
- How different surfaces interact with sound waves
- Human auditory system
- Units of sound measurement (Hz, dB)
- Sound Wave Theory
- Circle of 5^{th} Theory
- Constructive vs. destructive interference
- Doppler effect
- Families of instruments
- Music Theory
- Notes, Scales
- Common music terms

Vocabulary

Acoustic pressure
Compressions
Diffraction
Dispersion
Displacement amplitude
Doppler effect
Flats
Frequency
Harmonics
Intensity
Interference
Key
Key signature
longitudinal wave
Loudness
Major scales
Minor scales
Note names
Octaves
Overtones
Partials
Pitch
Power relating to sound
Rarefactions
Reflection
Refraction
Resonance
Sharps
Speed
Speed
Tempo
Largo: widely (i.e., slowly)
Lento: slowly
Moderato: moderate
Allegro: fast
Presto: very fast
Wavelength

Part 2: Sound Quality (~ 3 minutes to judge)

- The Event Supervisor will use an online tuner to test the teams. An online music tuner detects the pitch of the notes played on an instrument and indicates whether they are sharp (too high), flat (too low), or in tune. It helps musicians adjust their instruments to achieve the correct pitch for optimal sound.
- The teams will have 2 minutes, using the provided materials, to construct and test two musical notes between C4 (Middle C - approximately 261.63 Hz), and C5 (approximately 523.25) Hz of their choosing.
- The first note will not be graded but will be used by the teams to get used to the materials and the tuner. They will have full view of the online tuner as they are testing for this note.
- The Event Supervisor will then hide the tuner from the team for the rest of their time and the team will prepare their second and official note using their remaining time.
- At the end of the two minutes or before, the team will notify the Event Supervisor they are ready to play their second note.
- Teams may use the mallet up to three hits to receive a recorded measurement

Scoring:

a. Acronyms
  i. Competition Assessment Score (CAS) = the highest assessment score for all teams
  ii. Team Assessment Score (TAS) = the team assessment score
  iii. Competition Sound Score (CSS) = the lowest sound score for all teams (closest score to the sound chosen to create)
  iv. Team Sound Score (TSS) = the sound score for the team
  v. Final Score (FS)
  vi. Assessment Score (TAS ÷ CAS) x 50; rounded to the 100th place value; maximum 50 points
  vii. Sound Score (CSS ÷ TSS) x 50; rounded to the 100th place value; maximum 50 points

b. Example
  i. (CAS) = 15. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 15) x 50 = 30 points
  ii. (CSS) = 3.56 seconds. The team's time is 1.45. (TSS) for the team= (1.45 ÷ 3.56) x 50 = 20.36 points
  iii. (FS) = 30 + 20.36 = 50.36 points

Tiebreakers:

- 1st, Best sound quality
- 2nd, Best knowledge score

Possible Resources:

1. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

2. **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
    i. **Sounds of Music Pitch Test 2023**
    ii. Your music teacher.

Study Guide: Acoustics and Music Theory

This study guide will help you prepare for your test on acoustics and music theory. Remember, the test will have 25-40 questions.

I. Principles of Acoustics

- What is Acoustics? The science of sound.
- Sound Waves: Sound travels in waves.
    - Longitudinal Wave: The particles of the medium vibrate parallel to the direction the wave travels (like a slinky). Sound waves are longitudinal.
    - Compressions: Areas of high pressure in a sound wave (particles are close together).
    - Rarefactions: Areas of low pressure in a sound wave (particles are spread apart).
- Frequency: The number of sound wave cycles per second. Measured in Hertz (Hz).
    - High frequency = High pitch (like a whistle)
    - Low frequency = Low pitch (like a tuba)
- Amplitude: The height of a sound wave. Related to loudness.
    - Large amplitude = Loud sound
    - Small amplitude = Soft sound
- Wavelength: The distance between two corresponding points on a wave (e.g., from one compression to the next compression).
- Speed of Sound: How fast sound travels. Depends on the medium (faster in solids than in liquids or gases).
- Intensity: The amount of energy a sound wave carries per unit area.
- Power: The rate at which sound energy is produced.
- Acoustic Pressure: The variation in pressure caused by a sound wave.
- Displacement Amplitude: The maximum distance that particles of a medium move from their resting position as a wave passes through.

II. How Surfaces Interact with Sound Waves

- Reflection: Sound waves bounce off a surface.
    - Echo: A reflected sound wave.
- Absorption: Sound waves are taken in by a surface (e.g., soft materials like carpets absorb sound).
- Transmission: Sound waves pass through a surface.
- Refraction: Sound waves bend as they pass from one medium to another (e.g., from air to water) because the speed of sound changes.
- Diffraction: Sound waves bend around obstacles or spread out through an opening.
- Dispersion: The spreading of a wave, where different frequencies travel at different speeds.
- Resonance: An object vibrates with increased amplitude when exposed to a sound wave of its natural frequency.

III. Human Auditory System

- The Ear: The organ that detects sound. (You don't need to go into extreme detail for middle school, but know the basic parts: outer ear, middle ear, inner ear.)
- How We Hear: Sound waves enter the ear, are converted to vibrations, and then to electrical signals that the brain interprets.

- Loudness: How we perceive the intensity of sound.
- Pitch: How we perceive the frequency of sound.

IV. Units of Sound Measurement
- Hertz (Hz): The unit of frequency. 1 Hz = 1 cycle per second.
- Decibel (dB): The unit of sound intensity level or loudness. A logarithmic scale.

V. Sound Wave Theory
- See Section I: Principles of Acoustics

VI. Constructive vs. Destructive Interference
- Interference: When two or more sound waves overlap.
- Constructive Interference: When waves combine to make a larger amplitude (louder sound). This occurs when the waves are in phase (crests align with crests).
- Destructive Interference: When waves combine to make a smaller amplitude (softer sound, or even silence). This occurs when the waves are out of phase (a crest aligns with a trough).

VII. Doppler Effect
- Doppler Effect: The change in perceived frequency (and pitch) of a sound wave when the source of the sound and the listener are moving relative to each other.
    - If the source is moving towards you, the pitch sounds higher.
    - If the source is moving away from you, the pitch sounds lower.

VIII. Families of Instruments
- String Instruments: Instruments that produce sound by vibrating strings (e.g., violin, guitar, cello, piano, harp).
- Woodwind Instruments: Instruments that produce sound by blowing air into a mouthpiece, causing a reed or air column to vibrate (e.g., flute, clarinet, oboe, saxophone, bassoon).
- Brass Instruments: Instruments that produce sound by buzzing your lips into a mouthpiece (e.g., trumpet, trombone, French horn, tuba).
- Percussion Instruments: Instruments that produce sound by being struck, shaken, or scraped (e.g., drums, cymbals, xylophone, piano).

IX. Music Theory
- Music Theory: The study of how music works.

X. Notes and Scales
- Note: A symbol representing a musical sound.
    - Note Names: A, B, C, D, E, F, G
    - Octaves: The interval between one musical pitch and another with double its frequency.
    - Sharps (#): Raise a note by a half step.
    - Flats (♭): Lower a note by a half step.
- Scale: A sequence of musical notes in ascending or descending order.
    - Major Scales: A specific pattern of whole and half steps that sounds bright or happy.
    - Minor Scales: A specific pattern of whole and half steps that sounds darker or sadder.
- Key: The central note, scale, or chord in a piece of music.
- Key Signature: Sharps or flats at the beginning of a piece of music that indicate the key.

XI. Common Music Terms
- Tempo: The speed of the music.
    - Largo: Very slow
    - Lento: Slow
    - Moderato: Moderate speed
    - Allegro: Fast
    - Presto: Very fast

Storm the Castle (Coach Scheduled Testing - 45 Minutes)

Description: This event will test a team's ability to design and build a simple catapult to launch a small item onto a target and answer questions on a written assessment on the history of and types of catapults.

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

Spirit of the Problem:

- ➢ **The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).**
- ➢ **It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.**

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring

- Scissors and/or Makedo Safe Saw and a ruler.

Materials Provided at Event:

- 1 ≈ 15.24 cm x 10.16 cm x 7.62 cm mailing box
- 2 ≈ 16 cm bamboo spoons
- 1 meter of 2.54 cm masking tape
- 4 Rubber bands – student choice from an assortment of sizes #64, #33, and #19
- 2 pieces of Dots candy

The Competition:

1. **Written Assessment:**
   a. Teams will take a written test on the history of and types of catapults.
   b. *As a part of the written test the team will estimate their distance to the target point in centimeters.*

2. **The Build**
   a. The team of students will have a maximum of 30 minutes to construct their catapult and test

i. The distance to the target is 150 cm
ii. Each team will receive the exact same type and number of building materials and projectiles
iii. Teams may test their catapult on the target course with the permission of the Event Supervisor
iv. The judges will use a separate, but identical projectile for testing
v. Catapults must be freestanding and may not be attached to a tabletop, floor, ceiling, or other support
vi. Catapults may be placed anywhere inside the launch area and behind the 150 cm launch line.

3. Scoring:

a. Acronyms
   i. Competition Distance Score (CDS) = the closest distance measurement to the center of the target
   ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
   iii. Final Score (FS)
   iv. Team Distance Score (TDS)
   v. Team Assessment Score (TAS)

b. Final Score (FS) = (TAS) + (TDS). The maximum score is 100 points.
   i. Assessment Score = (TAS ÷ CAS); rounded to the 100th place value
   ii. Distance Score = (CDS ÷ TDS); rounded to the 100th place value

c. Example
   i. (CAS) = 13. The team scores 6 on the assessment. (TAS) for the team= (6 ÷ 13) = 23.07 points
   ii. (CDS) = 0.5 cm. The team's distance score is 25 cm. (TDS) for the team= (0.5 ÷ 25) = 0.2 points
   iii. (FS) = 23.07 + 0.2 = 23.27 points

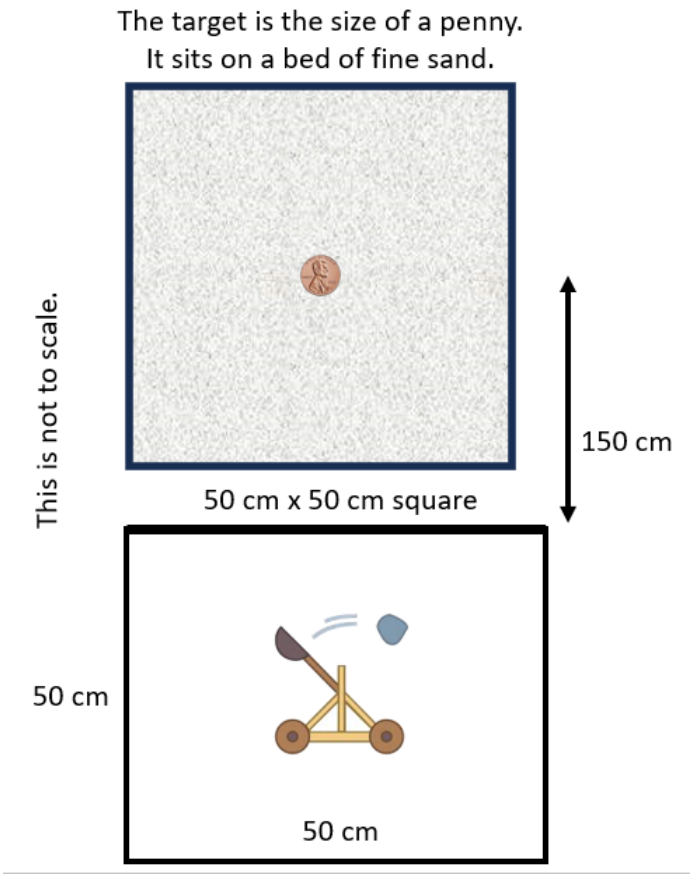
4. Tiebreakers:

a. Closest to the center of the target.
b. Answers to select questions on the written test.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
- Storm the Castle - Wiki - Scioly.org
- Design a Catapult - Informal Learning Activity - TeachEngineering

Example of the target area:



Sample Study Guide: Catapults: Ancient Engines of War

Introduction

- Catapults were powerful weapons used in ancient times to hurl projectiles over long distances.
- They played a crucial role in warfare, particularly in sieges.

History

- **Early Origins:**
  - The first catapults were developed in ancient Mesopotamia and Egypt.
  - They were initially simple devices used to launch stones and other projectiles.
- **Greek and Roman Innovations:**
  - The Greeks and Romans further developed catapult technology.
  - They introduced more sophisticated designs and improved their accuracy and power.

Types of Catapults

- **Ballista:**
  - A powerful crossbow-like weapon that could launch heavy bolts.
  - Often used to target enemy soldiers and fortifications.
- **Onager:**
  - A simple catapult that used a counterweight to launch projectiles.
  - Could hurl large stones over considerable distances.
- **Trebuchet:**
  - A large and powerful catapult that used a swinging arm and counterweight.
  - Capable of launching massive projectiles, including boulders.
- **Mangonel:**
  - A torsion-powered catapult similar to the ballista.
  - Could launch a variety of projectiles, including stones and flaming materials.

Impact on Warfare

- Catapults revolutionized siege warfare, allowing attackers to breach fortified walls more easily.
- They were also used in field battles to disrupt enemy formations and inflict casualties.
- The development of catapults led to advancements in engineering and mechanics.

Conclusion

- Catapults were remarkable feats of engineering for their time.
- They played a significant role in the history of warfare and continue to fascinate people today.

Additional Resources

- **Books:** Search for books on ancient warfare and siege engines.
- **Websites:** Explore educational websites with information on catapults and ancient technology.
- **Museums:** Visit museums with exhibits on ancient warfare and siege engines.

Super Sleuths (On the team schedule - 30 minutes)

Description: Teams will receive a scenario, a collection of evidence, and possible suspects. Then perform a series of tests, review other evidence, to answer questions and solve a 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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Teams Must Bring:

- ANSI Z87 D3 Splash/Droplet standards; goggles must be worn during all event testing.
- 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.

Category C: Indirect Vent Goggles

Eyeglasses and Safety Glasses are not safety rated for this event!

The Competition

1) **Materials:** Every team will have the same set of unknowns (evidence). Participants will be provided with a magnet, deionized water, pH paper, and a magnifying glass.

2) Hands on station with the help of the Event Supervisor:

a) Qualitative Analysis: Teams will identify evidence by performing tests such as solubility, magnetic properties, acidity, and color.
   i) Powders: Cornstarch, Baking Soda, Gelatin, Yeast, Sand, Ascorbic Acid
   ii) Liquids: Lemon juice, Hydrogen Peroxide, Water, Soap
   iii) Metals: Iron, Copper, Aluminum

3) **Polymer Testing/Natural and Man-Made Substances**: Teams will have to identify and analyze evidence from a variety of sources.

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

4) **Other Evidence:** Teams will identify and analyze other forms of evidence, and may need to answer knowledge questions related to them. They will have to use these to help solve the case.
   a) Fingerprints: identify different patterns on fingerprint evidence such as the difference between whorls, loops, and arches.
   b) Shoe/Tire Prints: compare prints and make conclusions, including direction and speed.
   c) DNA: compare DNA chromatograms from materials found on the scene to those of the suspects.

5) **Analysis:** Participants will be asked to write an analysis of the crime scene explaining not only which pieces of evidence implicate which suspect(s) and why the suspect was (were) chosen as the culprit(s), but also why the other suspects were not chosen.

Possible Resources:

- Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.
- **Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.**
  i. **Crime Busters - Wiki - Scioly.org**
  ii. **Crime Busters | Science Olympiad**

Crime Scene Investigation Study Outline

This outline is designed to help you prepare for an event where you analyze evidence to solve a crime.

I. Understanding the Scenario and Evidence (General)

- A. Scenario Comprehension:
  - Carefully read and understand the crime scenario provided.
  - Identify the key facts, the victim (if applicable), and the initial circumstances.
  - Note any specific details or constraints mentioned.
- B. Evidence Organization:
  - Recognize that evidence will be presented in various forms (physical samples, images, descriptions, data).
  - Develop a system for organizing and labeling the evidence as you receive it.
  - Consider creating a chart or table to track evidence and potential connections to suspects.
- C. Suspect Profiles:
  - Pay close attention to the information provided about each suspect.
  - Note any potential motives, relationships to the victim or scene, and any initial pieces of evidence linking them.
- D. Question Analysis:
  - Understand that you will need to answer specific questions based on your analysis of the evidence.
  - Pay attention to the wording of the questions to ensure you are addressing all aspects.

II. Hands-on Station: Qualitative Analysis

- A. General Principles:
  - Understand the concept of qualitative analysis – identifying substances based on their observable properties.
  - Familiarize yourself with basic laboratory safety procedures.

- Practice making careful observations and recording your results accurately.

- B. Powders:
  - Cornstarch: Understand its appearance, texture, solubility in water (forms a suspension).
  - Baking Soda: Know its effervescent properties when mixed with an acid (production of gas), slightly basic pH.
  - Gelatin: Understand its appearance (powder/sheets), solubility in warm water (forms a gel upon cooling).
  - Yeast: Recognize its granular appearance, characteristic odor, and its ability to produce gas in the presence of sugar and warm water.
  - Sand: Understand its granular texture, insolubility in water, and lack of significant chemical reactivity.
  - Ascorbic Acid (Vitamin C): Know its appearance (white crystalline powder), solubility in water (acidic solution).
  - Practice: Be able to differentiate these powders based on the listed tests (solubility, magnetic properties (none), acidity (litmus paper), color, odor).
- C. Liquids:
  - Lemon Juice: Understand its appearance, characteristic odor, and acidic nature.
  - Hydrogen Peroxide: Know its appearance (clear liquid), potential for bubbling/decomposition, and its oxidizing properties.
  - Water: Understand its appearance (clear, odorless), neutral pH, and its role as a universal solvent.
  - Soap: Recognize its soapy feel, ability to create suds, and slightly basic pH.
  - Practice: Be able to differentiate these liquids based on the listed tests (solubility (if applicable), magnetic properties (none), acidity (litmus paper), color, odor).
- D. Metals:
  - Iron: Understand its appearance (gray/black, often rusty), magnetic properties.
  - Copper: Know its characteristic reddish-brown color, non-magnetic properties.
  - Aluminum: Understand its silvery-gray appearance, lightweight, non-magnetic properties.
  - Practice: Be able to differentiate these metals based on their appearance and magnetic properties.

III. Polymer Testing/Natural and Man-Made Substances

- A. Hair:
  - Human Hair: Study the general characteristics (medulla, cortex, cuticle). Understand the variability in thickness, color, and presence of a medulla.
  - Dog Hair: Learn the typical characteristics (scale patterns on the cuticle, medulla structure).
  - Cat Hair: Learn the typical characteristics (scale patterns on the cuticle, medulla structure).
  - Practice: Be able to identify hair samples as likely human, dog, or cat based on provided microscopic images or descriptions. Focus on key distinguishing features.
- B. Fibers:
  - Animal Fibers: Understand their protein-based composition (e.g., wool, silk). Know their general microscopic appearance and burning characteristics (smell of burning hair).
  - Vegetable Fibers: Understand their cellulose-based composition (e.g., cotton, linen). Know their general microscopic appearance and burning characteristics (smell of burning paper).
  - Synthetic Fibers: Understand they are man-made (e.g., nylon, polyester, rayon). Know their general microscopic appearance (often uniform) and burning characteristics (often melt or produce chemical odors).

    - Practice: Be able to classify fibers as animal, vegetable, or synthetic based on provided microscopic images, information about their source, or descriptions of their properties.
- C. Recyclable Plastics:
    - HDPE (High-Density Polyethylene): Understand its common uses (milk jugs, detergent bottles), general properties (rigid, opaque or translucent).
    - PETE (Polyethylene Terephthalate): Understand its common uses (soda bottles, water bottles), general properties (clear, lightweight).
    - PMMA (Polymethyl Methacrylate or Acrylic): Understand its common uses (plexiglass), general properties (clear, rigid).
    - PS (Polystyrene): Understand its common uses (styrofoam, some food containers), general properties (can be rigid or foamy, often brittle).
    - Practice: Be able to identify these plastics based on their common uses, appearance, and potentially provided recycling codes.

IV. Other Evidence

- A. Fingerprints:
    - Basic Fingerprint Patterns: Learn to identify the three main fingerprint patterns:
        - Whorl: Circular or spiral patterns with two or more deltas.
        - Loop: Ridges enter and exit on the same side, with one delta.
        - Arch: Ridges enter on one side and exit on the opposite side, no deltas.
    - Practice: Be able to classify provided fingerprint evidence into these three basic patterns.
- B. Shoe/Tire Prints:
    - Comparison: Understand how to compare unknown prints with known shoe or tire impressions. Look for similarities and differences in tread patterns, size, and unique wear marks or damage.
    - Direction and Speed: Understand how the spacing and clarity of prints can provide clues about the direction of travel and potentially the speed (e.g., running vs. walking).
    - Practice: Be able to analyze and compare provided shoe or tire prints to draw conclusions about potential matches, direction, and speed.
- C. DNA:
    - DNA Chromatograms: Understand that DNA analysis often results in chromatograms (graphs with peaks representing DNA fragments).
    - Comparison: Learn how to compare DNA chromatograms from evidence found at the scene with those of the suspects. Look for matching patterns of peaks.
    - Interpretation: Understand that a match in DNA chromatograms strongly suggests the individual was present at the scene or had contact with the evidence.
    - Practice: Be able to compare provided DNA chromatograms and determine if there are matches between the crime scene samples and the suspects.

V. Analysis and Conclusion

- A. Connecting Evidence to Suspects:
    - Systematically review each piece of evidence and determine which suspect(s) it potentially links to.
    - Clearly articulate *why* a particular piece of evidence is incriminating for a specific suspect (e.g., "The fingerprint pattern on the weapon matches a known whorl pattern of Suspect B.").
- B. Identifying the Culprit(s):

    - Based on the totality of the evidence, determine which suspect(s) is/are the most likely culprit(s).
    - Prioritize evidence that is more direct or unique.
- C. Explaining Exoneration:
    - For each suspect who is *not* chosen as the culprit, clearly explain *why* they were eliminated.
    - Reference specific pieces of evidence that either exclude them or point more strongly towards another suspect.
    - Address any evidence that might initially seem to implicate them but is ultimately explained by other factors.
- D. Writing the Analysis:
    - Organize your analysis in a clear and logical manner.
    - Start with a brief summary of the crime and the key question (who is the culprit?).
    - Discuss each piece of evidence and its relevance to the suspects.
    - Clearly state your conclusion, identifying the culprit(s).
    - Provide a detailed explanation of your reasoning, referencing specific evidence and explaining why other suspects were eliminated.
    - Ensure your analysis is well-supported by the evidence and addresses all parts of the prompt.

VI. General Study Tips

- Review relevant science concepts (e.g., basic chemistry, biology).
- Practice identifying the different types of evidence described.
- Work through practice scenarios if available.
- Develop strong observation and analytical skills.
- Learn to communicate your findings clearly and concisely.
- Understand the importance of careful and accurate record-keeping.

By studying this outline and practicing your skills, you will be well-prepared to analyze the evidence and solve the crime! Good luck!

Example Crime Scene Analysis

Instructions: Fill out the following pages for each of the suspects using the information collected throughout the rest of the test. Make sure to include any and all evidence, and consider motives and how much evidence each suspect has.

[Suspect 1 Name]: Mrs. Plum

Circle one: GUILTY or NOT GUILTY

Any Motives? She was hungry at the time of the crime.
Associated Evidence: Cat Hair, whorled fingerprint, HDPE plastic is used by the restaurant for carry out boxes, the keys were made out of aluminum, and the traces of Alka-Seltzer at the crime scene.
Explanation of Ruling: 1. Mrs. Plum, Bugs Bunny and Sponge Bob had a pet cat or lived with one. Rules out Bob the Builder and Paddington Bear 2. The fingerprints of two of the suspects were whorled (Mrs. Plum and Sponge Bob). Rules out Bugs Bunny 3. HDPE carry out boxes are used at two of the eateries on the list. Mrs. Plum and Sponge Bob eat at these places 4. Mrs. Plum was the only suspect reporting to have an upset stomach and needing Alka-Seltzer

[Suspect 2 Name]: Sponge Bob

Circle one: GUILTY or NOT GUILTY

Any Motives? He was hungry at the time of the crime.
Associated Evidence: Cat Hair, whorled fingerprint, HDPE plastic is used by the restaurant for carry out boxes, the keys were made out of aluminum, and the traces of Alka-Seltzer at the crime scene.
Explanation of Ruling: 1. Sponge Bob has a pet cat 2. Sponge Bob and whorled fingerprints 3. Bob eats at a place that uses HDPE carry out boxes 4. Sponge Bob did not need Alka-Seltzer

Weather: Storms (On the team schedule - 30 minutes)

Description: Teams will answer questions on a written assessment on extreme stormy weather topics including meteorological terms, techniques, events, instruments and will create a simple weather instrument using given materials.

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

Spirit of the Problem:

- ➢ The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).
- ➢ It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Teams Must Bring:

- Pen/Pencil
- Scissors

Competition:

Both parts of this event will run concurrently during testing. Teams will take a written test to answer topic questions on weather and storms and build a weather instrument.

Part 1: Teams will take a written test to answer topic questions on Weather & Storms. It will include

- Basic weather terms & Water cycle
- Weather instruments and their functions
- Weather patterns & seasonal changes in weather
- Types of weather phenomena
- Life cycle of storms
- Analyze weather charts and maps

Part 2: Teams will build one simple weather instrument of their choice using the materials provided. As an open question on their test, they will describe the instrument they build and its uses in weather reporting.

a. Teams will have access to the following materials and do not have to use all of them in their chosen instrument
   - 1 – Straight Pin
   - 1 sheet of card stock
   - 3 – 3 oz cups
   - 1 meter, 2.54 cm masking tape
   - 3 – paper straws
   - 1 – 12-inch round balloon
   - 1 – Pencil
   - 1 – sheet of 3.5 x 5-inch cardboard
   - 1 – 16 oz wide mouth cup

Scoring:

1. Acronyms
   a. Competition Assessment Score (CAS) = the highest assessment score for all teams
   b. Competition Rubric Score (CRS) = the highest score for the weather instrument build for all teams
   c. Final Score (FS)
   d. Team Rubric Score (TRS)
   e. Team Assessment Score (TAS)
2. Final Score (FS) = Assessment Score + Rubric Score. The maximum score is 100 points.
   a. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100th place value
   b. Team Rubric Score = (TRS ÷ CRS) x 50 points; rounded to the 100th place value
3. Example
   a. (CAS) = 12. The team scores 7 on the assessment. (TAS) for the team= (7 ÷ 12) x 50 = 29.17 points
   b. (CRS) = 10. The team's build score is 8. (TRS) for the team= (8 ÷ 10) x 50 = 40 points
   c. (FS) = 29.17 + 40 = 69.17 points
4. Ties will be broken by the accuracy or quality of answers to select questions chosen by the test writer or the Event Supervisor.

Possible Resources:

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.

- **JetStream | National Oceanic and Atmospheric Administration**

Weather Instrument Rubric

Criterion	Emerging	Progressing	Excelling
Instrument Construction	- Assembled using basic materials - Recognizable shape or form related to its function	- Assembled with appropriate materials for functionality - Stable and demonstrates intended function - Shows planning and understanding of purpose	- Assembled with materials and techniques enhancing accuracy and durability - Fully functional and consistently demonstrates function - Includes innovative features or improvements
Explanation of Instrument Function	- Basic explanation of purpose - Mentions one use in weather reporting	- Clear explanation of how it works - Includes multiple uses in weather reporting - Connects function to specific weather phenomena	- Detailed explanation of mechanics and principles - Multiple, specific examples of professional use - Insights into limitations and potential improvements
Presentation and Communication	- Basic introduction of the instrument - Simple language used	- Structured introduction, body, and conclusion - Clear and precise language - Includes visual aids or demonstrations	- Engaging and well-organized presentation - Appropriate use of technical language - Interactive elements or audience engagement strategies

Weather and Storms Study Outline

I. Basic Weather Terms & Water Cycle

- A. Basic Weather Terms:
  - Temperature: How hot or cold the air is.
  - Air Pressure: The weight of the air pressing down on Earth.
  - Humidity: The amount of water vapor in the air.
  - Wind: Moving air.
  - Precipitation: Water falling from the sky (rain, snow, hail, sleet).
  - Clouds: Collections of tiny water droplets or ice crystals.
- B. The Water Cycle:
  - Evaporation: Liquid water turning into water vapor.
  - Condensation: Water vapor turning into liquid water (forming clouds).
  - Precipitation: Water falling back to Earth.
  - Collection/Runoff: Water gathering in rivers, lakes, and oceans.
  - Diagram: A labeled diagram of the water cycle.

II. Weather Instruments and Their Functions

- A. Instruments:
  - Thermometer: Measures temperature.
  - Barometer: Measures air pressure.
  - Hygrometer: Measures humidity.
  - Anemometer: Measures wind speed.
  - Wind Vane: Shows wind direction.
  - Rain Gauge: Measures rainfall.
  - Weather Satellite: Provides images of cloud cover and weather patterns from space.
  - Weather Radar: Detects precipitation intensity and movement.
- B. Functions:
  - Explanation of what each instrument measures and how it helps predict weather.

III. Weather Patterns & Seasonal Changes in Weather

- A. Weather Patterns:
  - High-Pressure Systems: Generally bring clear skies and calm weather.
  - Low-Pressure Systems: Often bring cloudy skies, precipitation, and windy conditions.
  - Fronts: Boundaries between air masses with different temperatures and humidity.
    - Cold Front: Cold air replacing warm air (often brings storms).
    - Warm Front: Warm air replacing cold air (often brings steady rain).
    - Stationary Front: A front that is not moving.
    - Occluded Front: A cold front overtaking a warm front.
- B. Seasonal Changes:
  - Spring: Transition from cold to warm, increased rainfall, thunderstorms.
  - Summer: Hot and humid, thunderstorms, heat waves.
  - Autumn (Fall): Transition from warm to cold, cooler temperatures, colorful foliage.
  - Winter: Cold temperatures, snow, ice.
  - Explanation of how the tilt of the Earth causes seasonal changes.

IV. Types of Weather Phenomena

- A. Common Phenomena:
  - Thunderstorms: Heavy rain, lightning, thunder, strong winds.
  - Tornadoes: Rotating column of air extending from a thunderstorm to the ground.
  - Hurricanes (Typhoons, Cyclones): Large, rotating storms with strong winds and heavy rain.
  - Blizzards: Heavy snow, strong winds, low visibility.
  - Heat Waves: Prolonged periods of excessively hot weather.

- Droughts: Prolonged periods of little to no rainfall.
- Floods: Overflow of water onto normally dry land.

V. Life Cycle of Storms

- A. Thunderstorms:
  - Cumulus stage, mature stage, dissipating stage.
- B. Hurricanes:
  - Tropical disturbance, tropical depression, tropical storm, hurricane.
- C. Tornadoes:
  - Formation within a thunderstorm, funnel cloud development, touchdown.

VI. Analyze Weather Charts and Maps

- A. Map Symbols:
  - Understanding symbols for high and low-pressure systems, fronts, and precipitation.
- B. Interpreting Maps:
  - Identifying weather patterns, predicting weather changes, and understanding weather forecasts.
  - Examples: Practice analyzing sample weather maps.
- C. Isobars:
  - Understanding how isobars show areas of equal pressure.

Study Tips:

- Use visual aids (pictures, diagrams, videos).
- Create flashcards for weather terms and instruments.
- Practice reading and interpreting weather maps.
- Watch weather forecasts on TV or online.
- Do hands-on activities, like building a simple rain gauge.

Wind Power (Coach Scheduled Testing - 45 Minutes)

Description: Teams will build and test a blade assembly for a wind turbine that will create the largest amount of usable electrical power, and answer questions on a written assessment on the history of and types of wind turbines.

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

Spirit of the Problem:

- ➢ **The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect (see Science Olympiad Pledges below). Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage).**
- ➢ **It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.**

Safety Teams Must Bring:

- **Safety glasses labeled ANSI Z87+ (impact rated)**
- **All competitors must wear their eye protection during any competitor's flight 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.**

Category B: Impact Safety Glasses Required

Eyeglasses are not safety rated!

Teams must bring:

- Writing Utensils
- Ruler
- Scissors
- Optional: Protractor

Materials provided at event:

- 2 - 22.86 cm Paper plates
- 8 cm Mini CD
- 1 meter of masking tape
- Wind power stand
- Box fan
- Voltmeter

The Competition: Teams will have 25 minutes to build and test a blade assembly and to complete the written assessment.

1. **Written Assessment:**

a. Teams will demonstrate their basic understanding of the use of wind to produce renewable energy
b. During the assessment, the team will write down their estimate of the number of volts their assembly will create

2. <u>The Build</u>

a. All teams will receive the same materials to build a blade assembly that produces the most electrical voltage measured by a voltmeter
b. **<u>The blade assembly may not have a radius that extends more than 20 cm from the origin, as measured from the center of the CD to the end of the blade tip</u>**
c. They do not need to use all of the materials and may make as many blades as they want for their assembly
d. They may ask the Event Supervisor for permission to assess their assembly for balance and fit during the 25-minute building time. **<u>They will not test for electrical output at this time</u>**
e. When the team is ready, they may ask for an official scoring from the Event Supervisor
f. Before the official testing, the team may position the fan or stand to help create electricity
g. <u>They may not move the fan or stand once testing begins</u>

3. <u>Event Supervisor Records</u>

a. Length of the blade assembly
b. Team Assessment score
c. Team Voltage Measurement
d. Team Voltage Estimate

4. <u>Scoring:</u>

a. <u>Acronyms</u>
   i. Competition Voltage Score (CVS) = the voltage for all teams
   ii. Competition Assessment Score (CAS) = the highest assessment score for all teams
   iii. Final Score (FS)
   iv. Team Voltage Score (TVS)
   v. Team Assessment Score (TAS)

b. <u>Final Score (FS) = Assessment Score (TAS) + Voltage Score (TVS)</u>. The maximum score is 100 points.
   i. Assessment score = (TAS ÷ CAS) x 50 points; rounded to the 100^{th} place value
   ii. Voltage Score = (TVS ÷ CVS) x 50 points; rounded to the 100^{th} place value

c. <u>Example</u>
   i. (CAS) = 11. The team scores 9 on the assessment. (TAS) for the team= (9 ÷ 11) x 50 = 40.91 points
   ii. (CVS) = 12.27 volts. The team's voltage is 1.45. (TVS) for the team= (1.45 ÷ 12.27) x 50 = 5.91 points
   iii. (FS) = 40.91 + 5.91 = 46.82 points

5. <u>Tiebreakers:</u>

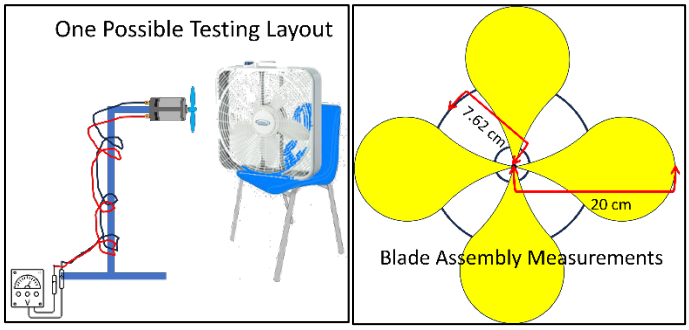
a. Closest estimate to the team voltage score
b. Best answers to select questions chosen by the test writer prior to the competition.

<u>Possible Resources</u>

a. Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events.

b. Use the listed resources and study guides as starting points. The study guide was created using Gemini AI and is meant as a beginning foundation! It may or may not contain topics occurring within the competition. It is up to the competitor to research further.
   i. Energy Kids – Renewable Wind
   ii. Energy Kids – Wind Explained – Generating Energy
   iii. Energy Kids – Wind Explained - History
   iv. NASA Climate Kids
   v. Science Olympiad – Division B – Wind Power
   vi. SciOly – Wind Power

Competition Diagrams



Study Guide: Wind Turbines: Power from the Wind

1) Introduction
   a) Wind turbines are machines that convert the kinetic energy of wind into electricity. They are a clean and renewable source of energy that is becoming increasingly popular around the world.

2) History of Wind Turbines
   a) Early Windmills: The first windmills were used to grind grain and pump water. They were developed in Persia (modern-day Iran) around 644 AD.
   b) Modern Wind Turbines: In the late 19th century, wind turbines were developed to generate electricity. These early turbines were small and inefficient, but they paved the way for the modern wind turbines we use today.
   c) Modern Wind Power: In the 1970s, there was a renewed interest in wind power as a result of the oil crisis. Since then, wind power has become one of the fastest-growing sources of renewable energy.

3) Types of Wind Turbines
   a) There are two main types of wind turbines:
      i) Horizontal-axis wind turbines (HAWTs): These are the most common type of wind turbine. They have a horizontal rotor that rotates around a vertical axis.
      ii) Vertical-axis wind turbines (VAWTs): These turbines have a vertical rotor that rotates around a horizontal axis. They are less common than HAWTs, but they can be more efficient in some situations.
4) How Wind Turbines Work
   a) Wind turbines work by converting the kinetic energy of the wind into mechanical energy. This mechanical energy is then used to turn a generator, which produces electricity.
5) The Benefits of Wind Power
   a) Clean energy: Wind power is a clean source of energy that does not produce pollution.
   b) Renewable energy: Wind power is a renewable source of energy that will never run out.
   c) Low operating costs: Once a wind turbine is built, the cost of operating it is very low.
6) The Challenges of Wind Power
   a) Intermittency: Wind power is intermittent, meaning that it is not always available.
   b) Visual impact: Wind turbines can have a visual impact on the landscape.

c) Noise pollution: Wind turbines can produce noise pollution.
d) The Future of Wind Power
e) Wind power is a promising source of renewable energy that is expected to play an increasingly important role in the future. As technology continues to improve, wind turbines are becoming more efficient and less expensive.

School Sponsorship Form

Science Olympiad is devoted to improving the quality of science education, increasing student interest in science and providing recognition for outstanding achievement in science education by both students and teachers. As such, the program has always required that teams be school-based, with all team members attending the same school.

School Affiliation

Teams participating in the Virginia Science Olympiad must be recognized as a school-sponsored organization by the principal (or equivalent) of the school. Signing this form and registering a team acknowledges this relationship.

Head Coach Authorization

The principal authorizes an adult head coach to act on behalf of the school team(s). The coach is a representative of the school and is responsible for ensuring that the team follows all school-established policies and procedures for student supervision, liability and safety. VASO highly recommends that coaches are school employees.

The head coach of the team(s) accepts the following duties:

- Acting as the VASO point of contact, receiving VASO communications and relaying relevant information to students, families and administration as needed
- Managing selection and organization of students to team rosters, including assigning events and partners
- Overseeing team preparations in advance of tournaments, including securing team volunteers
- Supervising student competition on-site for the duration of all tournament days
- Ensuring that all VASO policies are met by the team and associated parties

School-Based Sponsorship

If the coach is not a school employee, VASO highly recommends head coaches work with a principal-designated school employee who can ensure compliance with school policies and support team administration, including organizing school paperwork necessary for travel to tournaments, procuring team supplies and meeting space, and assisting in team selection. This school employee will also receive VASO communications. A school is not required to have an additional sponsor, but they **must** have a head coach who accepts all duties as described above.

I have read and understand the VASO School Sponsorship Policy. By signing, I agree that the following is the authorized coach (and additional school-based sponsor, if applicable) for the school.

Principal	Name (Print): _____ Signature: _____ Date: _____
Head Coach	Name (Print): _____ Signature: _____ Date: _____
School-Based Sponsor (*if applicable*)	Name (Print): _____ Signature: _____ Date: _____

Team Expectations Form

Adherence to VASO Policies

Teams are expected to adhere to all posted Virginia Science Olympiad policies, requirements, and clarifications from www.virginiaso.org as if they were included in the official event rulebook.

Team Registration

Head coaches are required to complete registration with Virginia Science Olympiad for the season before their team competes in any tournament, even those run by organizations other than VASO.

Tournament Day Participation

School-approved, adult representatives are required to be on site for the duration of their team's presence at the tournament location. Head coaches are expected to fill this role and to be reachable via phone and/or email by tournament officials for the duration of the tournament. In the event that a head coach is unable to attend a tournament, it is the responsibility of the coach to designate a replacement who is authorized by the principal to represent the school, and to inform the tournament director of this change.

Participating teams are expected to provide volunteers to supervise and/or assist in events on tournament days when their team is competing. Teams that do not meet their volunteer requirement will not be eligible to compete. It is the responsibility of the head coach and other adults associated with the team to meet this requirement.

Conduct

Each sponsoring school is responsible for the conduct of its participants. Students, coaches and other adults are responsible for ensuring that any applicable school or Science Olympiad policy, law, or regulation is not broken. VASO policies regarding conduct notably include:

- Cheating and Misconduct Policy
- Parent Participation Policy
- Clean Up Policy

Vandalism

If a member(s) or person(s) on or associated with a team commit(s) an act of vandalism, the team may be disqualified from the competition. In egregious cases of vandalism, as determined by tournament officials, no member of that team will be awarded a medal in ANY event and persons may be barred from future competitions. Each sponsoring school agrees to pay the cost of repairing damage from any act of vandalism. Vandalism means a deliberate action that results in damage to property, including, but not limited to, graffiti, damage to facility property, and damage to others' personal property.

By signing below, I indicate that I have read and understand the VASO Team Expectations Policy.

Principal	Name (Print): _____ Signature: _____ Date: _____
Head Coach	Name (Print): _____ Signature: _____ Date: _____
School-Based Sponsor (*if applicable*)	Name (Print): _____ Signature: _____ Date: _____

VASO 2025-2026 Division A
Student Permission Form

For students to participate as part of their school Science Olympiad team, their parent/legal guardian must complete and sign this form. If this form is not completed, the student will **not** be allowed to compete on tournament day. This form can also be completed digitally at www.virginiaso.org/div-a-forms

Student Information

Student Legal Name _____

First Last

Student Nickname (*if applicable*) _____

Student School _____

Student Grade ☐ 3 ☐ 4 ☐ 5

Student Gender ☐ Male ☐ Female ☐ Non-Binary ☐ Decline to participate

Student Ethnicity (Choose all that apply)

- ☐ American Indian or Alaskan Native
- ☐ Asian
- ☐ Black or African American
- ☐ Hispanic or Latino
- ☐ Pacific Islander
- ☐ White
- ☐ Other
- ☐ Decline to participate

Gender and Student Ethnicity are optional, but please consider helping us as we work on educational grants and with various agencies. We only share this information in aggregate.

Number of Years Student Has Participated in Science Olympiad (*include this year)*

☐ 1 ☐ 2 ☐ 3

Student Permission Releases

Guardian Name _____
(the Person signing up Student) First Last

Guardian Email _____@_____._____
VASO does not share this information with anyone other than your head coach and it will be discarded at the end of the season.

Guardian Phone (_____) _____-_____
For emergency use on tournament day. VASO will discard this information at the end of the season.

All statements below must be acknowledged with initials in order for the student to participate.

Certification of Right to Fill Out Permission for the Student I certify that I am the legal guardian of the student.	_____ *Initials*
Permission for the Student to Participate I understand that participation in Virginia Science Olympiad ("VASO") activities involves a certain degree of risk and can be physically, mentally, and emotionally demanding. I have carefully considered the risk involved and have given consent for my child to participate in this activity. I also understand that participation in this activity is entirely voluntary and requires participants to abide by applicable rules and standards of conduct. I understand that this may include participation in tournaments, training sessions, special events, competitions, and other activities related to VASO. It may also include travel under the supervision of the team coach or their authorized team representative. I release VASO, and all employees, volunteers, related parties, or other organizations associated with the activity from any and all claims, liability or cause of action arising out of this participation.	_____ *Initials*
Parent/Guardian Pledge I pledge to be an example for our children by: respecting the rules of Science Olympiad, encouraging excellence in preparation and investigation, supporting independence in design and production of all competition devices, and respecting the decisions of event supervisors and judges. Our examples will promote the spirit of cooperation within and among all our participating teams. I understand that parents are not allowed to construct any piece of competition devices. All work is to be done by students on the team. I recognize that it is a rules violation if coaches, parents, mentors, or spectators enter the competition area or talk to the team members at any time while they are competing. Violation of this rule will place the team below all other teams.	_____ *Initials*
Collection of Information In order to facilitate participation, VASO must collect some personal information (name, school, and grade) about my child over the internet. Information will only be shared with tournament personnel and will be destroyed at the beginning of the next season.	_____ *Initials*
Onsite Safety I acknowledge that my child will follow the site-required safety precautions for each event when present at Science Olympiad testing sites.	_____ *Initials*

Media Release I hereby consent and agree that VASO, and all employees, volunteers, related parties, or other organizations associated with the activity have the right to take photographs, videotape, or digital recordings of myself or my child and to use these in any and all media, for the purpose of promoting Science Olympiad and its related programs. The identity of minors will not be revealed without appropriate consent. I hereby release to VASO, its agents, and employees all rights to exhibit this work in print and electronic form publicly or privately and to market and sell copies. I waive any rights, claims, or interest I may have to control the use of my identity or likeness in whatever media used. I understand that there will be no financial or other remuneration for these rights.	_____ *Initials*
Digital Upload of Information I hereby consent and agree that the head coach of my child's team can and will input the information I have provided on this form into VASO's digital student permissions system.	_____ *Initials*

In signing this, I certify that I am 18 years of age or older and have the legal authority to give permissions for this student.

Guardian Signature _____ Date:_____