



See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.



ROBOT TOUR

1. **DESCRIPTION:** Teams design, build, program and test one Robotic Vehicle to follow track lines to reach a target at a set amount of time as accurately and efficiently as possible.

A TEAM OF UP TO: 2

IMPOUND: Yes

EVENT TIME: 12 minutes

2. **EVENT PARAMETERS:**

- a. Each team must bring and impound one Robotic Vehicle, a practice log, programming unit (except laptops), and any additional/spare parts.
 - i. If the programming unit is a laptop, then a USB Flash Drive must be impounded instead of the laptop. The USB drive must contain only one robot program that is the starting program for the robot.
- b. The practice log is the only paper or notes that the competitors may bring into the event area and must be impounded.
- c. Teams may bring tools which do not need to be impounded. Tools may include a stand-alone non-programmable, non-graphing calculator as defined in the calculator policy found on www.soinc.org.

3. **CONSTRUCTION PARAMETERS:**

- a. The autonomous robotic vehicle must be designed and programmed to follow track lines, make decisions at intersections, travel between gates, and stop at a designated target point on the track without external interactions.
- b. Electrical energy used by the Robot for any purpose, including propulsion, must be stored in a maximum of 8 (eight) AA 1.2 to 1.5-volt common, commercially available batteries, individually labeled by the manufacturer. Rechargeable batteries are allowed.
- c. Any battery containing lithium or lead acid is not permitted. Teams using these batteries will not be permitted to run and will receive only participation points.
- d. Batteries and robotic vehicle are to remain separate from the moment they are impounded until after the start of the team's time slot. At Impound, the batteries to be used must be submitted in a non-metallic container free of any items that might cause a short circuit. The robot should be submitted at the same time but physically separate from the batteries. Teams violating any of these conditions will have the opportunity to remedy the situation to the satisfaction of the Event Supervisor should time allow. The Event Supervisor will instruct the teams when to install the batteries and prepare their Robot for its run.
- e. An approximately 1/4" round wooden dowel must be attached to the front of the robot. When the robotic vehicle is in the ready-to-run configuration, the dowel must be approximately perpendicular to the floor, extend to within 1.0 cm of the floor, and extend at least 10.0 cm above the floor. The dowel must be the leading part of the Robot at all times and easily accessible by the Event Supervisor. The dowel attachment device may not extend more than 0.5 cm beyond the front of the dowel. The dowel's front bottom edge will be the Robot's Measurement Point for distance measurements.
- f. The entire Robot in the ready-to-run configuration must fit in any orientation in a 30.0 cm by 30.0 cm space of any height.
- g. All parts of the Robot must move as a whole; no tethers or other separate pieces are allowed. The only parts allowed to contact the floor during the run are parts already in contact with the floor in the ready-to-run configuration. Pieces falling off during the run constitutes a construction violation.
- h. Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

4. **PRACTICE LOG:**

- a. Teams must record the target time, run time, distance from target, and gates, if used, for at least 10 practice runs while varying (and recording) at least one Robot parameter (path taken, gates, ...) for each run.
- b. Logs must be impounded and will be returned when the team is called to compete.

5. **THE COMPETITION:**

- a. The start point, target point, target time, and number of gates to be passed along with their locations are chosen by the Event Supervisor (ES) and must not be announced until the impound period is over. The number of gates will be up to 3 for regionals, up to 4 for states and up to 6 for nationals. The target time will be chosen between 30 and 60 seconds.
- b. Only participants and the Event Supervisors will be allowed in the event area. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication.

ROBOT TOUR (CONT.)

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- c. Participants will be given an Event Time of 12 minutes to perform the following actions. The Event Supervisor will record the total event time used which may affect all scored runs. The Event Time will not include time used by the Event Supervisor for measuring. If a run has started before the 12-minute period has elapsed, it will be allowed to run to completion. The recorded event time must stop at 12 minutes.
 - d. Teams are allowed to make programming changes to achieve the maximum points during their event time.
 - i. If a laptop is the programming unit, then the competitors must open the single program file from the impounded USB drive in front of the Event Supervisor.
 - ii. Teams must only modify the impounded program file during the competition.
 - iii. Opening other files or referencing the Internet will result in their Final Score placed in Tier IV.
 - e. Competitors may not use AC outlet power during their time slot
 - f. Teams may have up to 2 successful runs or 3 failed runs (whichever comes first). Teams may ask to have the run recorded as a failed run and stop the run. Removing a Robot before the end of a run will be recorded as a failed run.
 - g. In the ready-to-run configuration, the Robot's Measurement Point must be over the Start Point with the Robot in any orientation. The Robot must remain at the starting position without being touched.
 - h. Teams may adjust their Robot (ex: programming changes, physical modifications, ...) during their event time. The Event Supervisor may re-verify that the Robot meets specifications prior to each run.
 - i. Teams must run their Robot on the track provided by the event supervisor. Running the Robot on any surface other than the event track will result in the team's next run being recorded as a failed run for each occurrence.
 - j. Participants may clean the track during their event time, but the track must remain undamaged and dry at all times. No wet and/or tacky substances may be applied to the track, wheels, or treads.
 - k. Teams must start the Robot using any part of an unsharpened #2 pencil with an unused eraser, supplied by the Event Supervisor, in any motion to actuate a trigger. They may not touch the Robot to start it, hold it while actuating the trigger, or "push" the Robot to get it started. Once they start a run, the participants must not touch their Robot and must wait until notified by the Event Supervisor to retrieve their Robot.
 - l. Run Time starts when the robot begins to move and ends when the Robot comes to a complete stop; recoils are considered part of the Run Time. If the robot does not move within 3 seconds after coming to a stop, the run is considered to have ended; the 3 seconds are not included in the Run Time. Any action occurring after that time does not count as part of the run. The event supervisor is encouraged to use three timers. The middle time of the 3 timers must be the official Run Time. The Run Time must be recorded in seconds to the precision of the timing devices.
 - m. A Gate Bonus is awarded for each Gate crossed in any order. Each Gate may only be counted once. The dowel rod or dowel attachment device must be the first part of the robot to travel across the Gate line.
 - n. A Failed Run occurs for any run that:
 - i. Does not finish within twice the target time
 - ii. The Robot exits the track area as determined by all Robot floor contact points being completely outside of the track's outer perimeter lines.
 - iii. If the time and/or distance cannot be measured for a Robot (e.g., it starts before the Event Supervisor is ready, the participants pick it up before it is measured).
 - o. If the Robot does not move upon actuation of the trigger, it does not count as a run and the team may set up for another run.
 - p. A team filing an appeal must leave their Robot and programming unit/USB in the competition area.
6. **THE TRACK:**
- a. The track area will be on a smooth, level, and hard surface. See website for track diagram PDFs with different printing options. One of these track PDFs must be used as the competition track.
 - b. The track area will be 4 circles with a diameter of 50cm. The circles are arranged 2 by 2 with the tangent points overlapping. The outer perimeter of the circles is connected by 4 straight lines. The track lines are approximately 1.9cm wide black lines on a white background.
 - c. The 12 intersection points are marked by an approximately 2.5 cm wide by 15cm long black line centered and perpendicular to the intersection point.



- d. Event Supervisor will use an approximately 1.9 cm by 1.9 cm pieces of tape to mark the Start and Target Points, with the Start and Target Point marked in the center each piece of tape. The Start Point may be placed at approximately halfway between any two intersection points. The Target Point may be placed at any intersection point.
 - e. Gates can be placed at approximately halfway between any two intersection points. A Gate cannot be at the same location as the Start point. The Gate is indicated by a 15cm thin line centered on the track line. The Gate line is marked by a single piece of tape 2.5 cm by 2.5cm at one end with a Gate letter (Ex: "A", "B", "R", "X", ...). There must be a gap of 6.0 cm between the Gate tape marker and all track lines.
 - f. At the Event Supervisor's discretion, more than one track may be used. If so, the team may choose which track they use. All runs must be on the same track.
7. **SCORING:**
- a. The team with the highest Final Score in the lowest tier number wins.
 - b. Each team's Final Score is their highest Run Score with the lowest tier number.
 - c. The Run Score for each run = Time Score + Distance Score + Gate Bonus + Penalties.
 - d. The Time Score is determined by:
 - i. Run Time less than Target Time: $\text{Time Score} = 90 - (\text{Target Time} - \text{Run Time}) \times 2$
 - ii. Run Time greater or equal to Target Time: $\text{Time Score} = 90 - (\text{Run Time} - \text{Target Time})$
 - e. The Distance Score = Robot Distance x -0.5. The Robot Distance is the point-to-point distance from the Measurement Point to the Target Point in centimeters measured to the nearest 0.1 cm.
 - f. Gate Bonus = 15 points for each gate crossed in any order.
 - g. Teams may incur the following Penalties that affect all Run Scores. Penalties do not affect Tier placement
 - i. Recorded Event Time will incur a penalty of -1 point per each 10 seconds beyond 8 minutes.
 - ii. Incomplete Practice Logs will incur a Penalty of -250 points.
 - iii. Teams without impounded Practice Logs will incur a Penalty of -500 points.
 - h. Tiers; the Tier with the highest number will be applied when more than one are applicable:
 - i. Tier 1: Runs with no violations.
 - ii. Tier 2: Runs with any competition violations.
 - iii. Tier 3: Runs with any construction violations.
 - iv. Tier 4: Teams that did not impound their Robot during the impound period.
 - i. Ties must be broken by this sequence: 1. Higher Time Score on scored run; 2. Lower Robot Distance on scored run. 3. Higher Gates Bonus on scored run. 4. Lower event time used. 5. Next better non-scored run score.
8. **SCORING EXAMPLE:** At a competition, the track has 3 Gates (A, B & C). Target Time is 43s. A team's Robot stopped 21.7 cm from the Target Point with a Run Time of 58.53 sec. Gates "C" and "A" were crossed. The team had a recorded Event Time of 8 minutes and 35 seconds. A valid log was impounded.

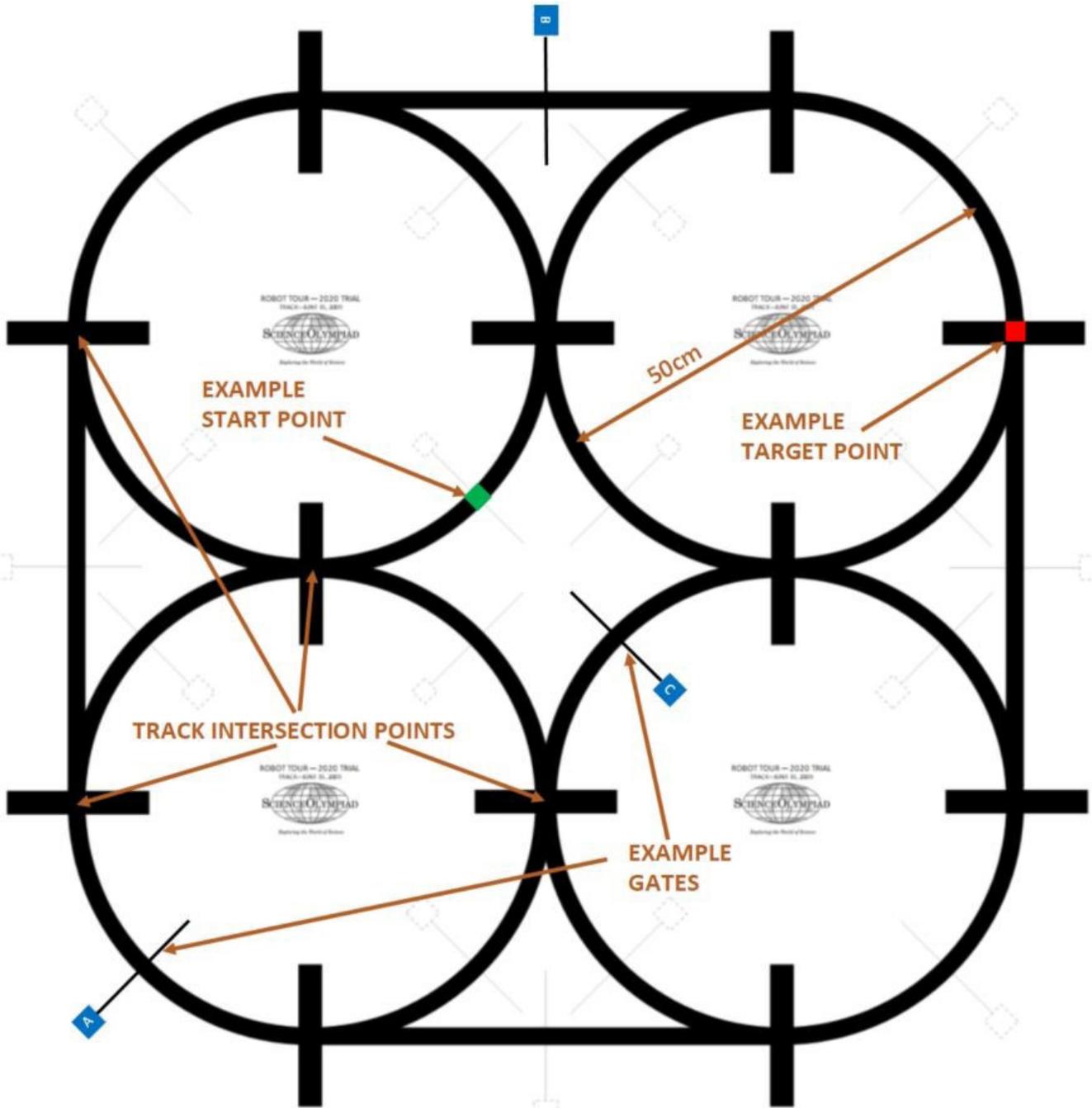
Time Score	= $90 - (58.53 - 43)$	= 74.47
Distance Score	= $21.7\text{cm} \times -0.5 \text{ pts/cm}$	= -10.85
Gate Bonus	= $2 \text{ Gates} \times 15 \text{ pts/Gate}$	= 30.00
Log Penalty	= 0	= 0.00
Event Time Penalty	= $-1 \times \text{Round Down} ((8:35 - 8:00)/10)$ = $-1 \times \text{Round Down} ((515\text{s} - 480\text{s})/10)$	= -3.00
Run Score		90.62

Recommended Resources: Resources for this event can be found on the Trial Event page at soinc.org.

ROBOT TOUR (CONT.)



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GENERAL RULES

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GENERAL RULES, CODE OF ETHICS, AND 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. 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 tournament director from the event, the tournament, or future tournaments.

1. Actions and items (e.g., tools, notes, resources, supplies, electronics, etc.) are permitted, unless they are explicitly excluded in the rules, are unsafe, or violate the spirit of the problem.
2. While competing in an event, participants may not leave without the event supervisor's approval and must not receive any external assistance. All electronic devices capable of external communication as well as calculator applications on multipurpose devices (e.g., laptop, phone, tablet) are not permitted unless expressly permitted in the event rule or by an event supervisor. Cell phones, if not permitted, must be turned off. At the discretion of the event supervisor, participants may be required to place their cell phones in a designated location.
3. Participants, coaches and other adults are responsible for ensuring that any applicable school or Science Olympiad policy, law, or regulation is not broken. All Science Olympiad content such as policies, requirements, clarifications/changes and FAQs on www.soinc.org must be treated as if it were included in the printed rules.
4. All pre-built devices presented for judging must be constructed, impounded, and operated by one or more of the 15 current team members unless stated otherwise in the rules. If a device has been removed from the event area, appeals related to that device will not be considered.
5. Officials are encouraged to apply the least restrictive penalty for rules infractions - see examples in the Scoring Guidelines. Event supervisors must provide prompt notification of any penalty, disqualification or tier ranking.
6. State and regional tournament directors must notify teams of any site-dependent rule or other rule modification with as much notice as possible, ideally at least 30 days prior to the tournament.

COVID-19 PANDEMIC RULES MODIFICATIONS

The COVID-19 pandemic requires that some general modifications be made to the Event Rules listed in this manual in order to permit Science Olympiad competitions to continue in a way that reflects best public health, disease prevention, and personal safety practices. The modifications listed here will be in effect for all Science Olympiad competitions, regardless of level (e.g., Invitational, Regional, State, National), or type (e.g., In-Person, Satellite SO, mini SO). As the pandemic is evolves, these modifications may be amended or rescinded according to local conditions. If changes are made, the Tournament Director for the affected tournament will make an announcement to all participating teams as soon as possible.

1. **If not already allowed, each individual participant can have a personal set of reference materials (e.g., binders, single sheets of paper), calculator, or other academic resource as specified in the specific event rule for use during the competition to facilitate social distancing, isolation, and to prevent resource sharing. Personal sets of resource materials must meet all the criteria established in the specific event rule. This does not apply to Recommended Lab Equipment for Division B or Division C Chemistry Events or tool kits for Build Events.**
2. **Given local conditions, participants may not be able to be in the same location as their partner during competition. Tournaments will allow designated partners to compete from separate locations and competing teams will only need one device for Build or Hybrid with Build Events.**
3. **At the discretion of the Tournament Director, portions of Hybrid Events containing hands-on activities as well as Build and Lab Events may be dropped from the tournament or be conducted as trial events.**
4. **At the discretion of the Tournament Director and Event Supervisors, completion time may be used as a tiebreaker for Core Knowledge and other events where a written or online test is used.**



For Event Supervisors Only - Do Not Post CHEMISTRY RECOMMENDED LAB EQUIP.

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

Each team may bring any or all of the items listed below for use in Division C Chemistry Events requiring laboratory equipment. Teams not bringing these items will be at a disadvantage as Event Supervisors will not provide Recommended Lab Equipment. A penalty of up to 10% may be given if a team brings prohibited lab equipment to the event.

Item & Expected Use	Likely to be used in:			
	Chemistry Lab	Forensics	Environmental Chemistry	Materials Science
Box - Containing all of the kit materials	X	X	X	X
10 ml Graduated Cylinder - Measuring volumes	X		X	
25 ml Graduated Cylinder - Measuring volumes	X		X	
100 ml Graduated Cylinder - Measuring volumes	X		X	
50 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
100 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
250 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
400 ml Beakers - Doing reactions, developing chromatograms	X	X	X	X
50 ml Erlenmeyer Flasks - Doing reactions	X		X	
125 ml Erlenmeyer Flasks - Doing reactions	X		X	
250 ml Erlenmeyer Flasks - Doing reactions	X		X	
Test Tubes - Mix Chemicals, heat chemicals	X	X	X	X
Test Tube Brush - Clean Test Tubes	X	X	X	X
Test Tube Holder - Holds test tubes for heating	X	X	X	
Test Tube Rack - Hold Test Tubes	X	X	X	X
Spot Plates - For semi-micro scale reactions, testing solubility, pH	X	X	X	
Petri Dishes - Doing reactions, developing chromatograms	X	X	X	X
Slides - To put hairs, crystals, or fibers on for use with a microscope		X		
Cover Slips - To cover & prevent items from coming off slides		X		
Droppers - Add small amounts of liquids to reactions	X	X	X	X
Spatulas or spoons - Getting small amounts of solids out of containers	X	X	X	X
Metal Tongs, Forceps, or Tweezers - Holding & retrieving objects	X	X	X	X
Stirring Rods - Stirring mixtures	X	X	X	X
Thermometer - Determining the temperature of a solution	X	X	X	
pH or Litmus paper - Test acidity or alkalinity of solution	X	X	X	
Hand Lens - Magnification of small items for identification		X		
Flame Loop - For identification of ions in a compound		X		
Cobalt Blue Glass - To filter out any sodium that might contaminate flame test from hands		X		
Filter Paper - Filter solids from liquids	X		X	
Funnel - Hold Filter Paper	X		X	
9V battery - Electrolysis	X		X	X
Alligator Clip Wires - Connecting meters to metals	X		X	X
Nail - Electrolysis	X		X	X
Piece of Cu metal - Electrolysis	X		X	X
Piece of Zn metal - Electrolysis	X		X	X
Multimeter - Measuring current, voltage, and resistivity	X		X	X
9V or less Battery Conductivity Tester - Determining ionic strength of solution	X	X	X	X
Calipers-mechanical, not digital - Measuring lengths very precisely	X			X
Paper Towels - Cleaning	X	X	X	X
Pencil - Writing, Marking Chromatogram		X		
Ruler - Measuring lengths		X		
Magnets - For extraction and identification of iron filings	X	X	X	X



For Event Supervisors Only - Do Not Post CALCULATOR CLASS DESCRIPTIONS

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

The following document was prepared to offer some guidance to teams as they select calculators for use in different Science Olympiad events. By no means are the calculators listed here inclusive of all possible calculators; instead they are offered as common examples. The decisions of the event supervisors will be final.

Class I - Stand-alone non-graphing, non-programmable, non-scientific 4-function or 5-function calculators

are the most basic type of calculators and often look like the one shown to the right. These calculators are limited to the four basic mathematics functions and sometimes square roots. These calculators can often be found at dollar stores.



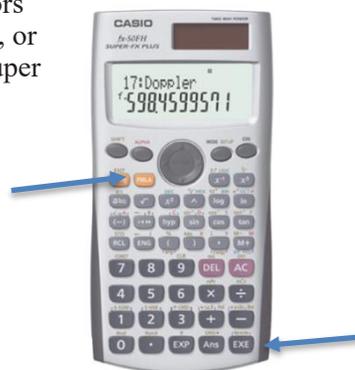
Class II - Stand-alone non-programmable, non-graphing calculators look like the calculator to the right or simpler. There are hundreds of calculators in this category but some common examples include: CASIO FX-260, Sharp EL-501, and TI-30X.



Class III- Stand-alone, programmable, graphing calculators and stand-alone non-graphing, programmable calculators, often look like the calculator shown on the right. Some examples are: Casio 975 0/9850/9860, HP 40/50/PRIME, and TI 83/84/89/NSPIRE/VOYAGE.

To identify a stand-alone non-graphing, programmable calculators are look for the presence of the 'EXE' button, the 'Prog' button, or a 'file' button. Examples include but are not limited to: Casio Super FXs, numerous older Casio models, and HP 35S. A calculator of this type with the buttons labeled is shown to the right.

PROG Button



EXE Button



Class IV - Calculator applications on multipurpose devices (e.g., laptop, phone, tablet, watch) are not allowed unless expressly permitted in the event rule.



EYE PROTECTION GUIDE

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

This resource was created to help teams comply with the Science Olympiad Policy on Eye Protection adopted on July 29, 2015 and posted on the Science Olympiad Website (soinc.org).

Participant/Coach Responsibilities: Participants 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 participants bring is adequate for the hazard. All protective eyewear must bear the manufacturer's mark Z87. At a tournament, teams without adequate eye protection will be given a chance to obtain eye protection if their assigned time permits. If required by the event, participants 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.

Compliant Eyewear Categories: If an event requires eye protection, the rules will identify one of these three categories. Compliance is 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 are able to 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

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.

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