



# STORM THE CASTLE

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.



1. **DESCRIPTION:** Prior to the competition, teams will design, construct, and calibrate a single device capable of launching projectiles onto a target and collect data regarding device parameters and performance.  
**A TEAM OF UP TO:** 2 **EYE PROTECTION:** B **IMPOUND:** Yes **APPROX. TIME:** 10 minutes
2. **EVENT PARAMETERS:**
  - a. Prior to the competition teams must collect and record launch device performance and calibration data.
  - b. Each team may bring tools, supplies, writing utensils, and stand-alone calculators of any type for use (these items need not be impounded). Each team must impound only one launch device and design log. Items must be moveable by the competitors without outside assistance.
  - c. Event Supervisors will provide the projectiles, counterweights, and target.
  - d. Participants must wear eye protection during device setup and operation. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows.
  - e. 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](http://www.soinc.org).
3. **CONSTRUCTION PARAMETERS:**
  - a. When ready-to-launch, the launch device, projectiles, stabilizing weights, **counterweights**, and all other device components (except for tools / supplies) must fit in a 65.0 cm per side cube, in any orientation chosen by the team.
  - b. The triggering device is not considered part of the device and activating it must not contribute significant energy to the launch. It must extend out of the launch area, allow for competitors to remain at least 75cm away from the launch area, and does not need to return to the launch area after launch. The triggering device must not pose a danger due to flying parts or excessive movement outside of launch area.
  - c. The launch device must be constructed to accommodate the supervisor provided counterweights and projectiles (see Section 6 for details). Teams may not modify the counterweights or projectiles.
  - d. The launch force must be entirely supplied by the gravitational potential energy from the supervisor provided falling counterweights. The device, without the counterweight and projectile, must not contribute energy to the launch. This includes any part of the device whose potential energy decreases, with the exception of items of nominal mass, such as strings and thin rods. Devices will be inspected to ensure that there are no other energy sources. At the supervisor's discretion, teams must disassemble devices after competing in order to verify this. Example violations, allowable types, and mechanisms for testing for added energy are available on [soinc.org](http://soinc.org).
  - e. The launch device must be designed and operated in such a way to not damage or alter the floor.
  - f. Electrical components are not allowed as part of the device or triggering device.
4. **DESIGN LOG:**
  - a. Teams must submit a design log showing collected device data, which should contain:
    - i. One or more photos and/or diagrams of the device with labels identifying all the major components and detailing their function, along with a brief summary of how the device was built.
    - ii. Any number of graphs and/or tables showing the relationship between various parameters such as arm position or projectile mass and impact position. Graphs/tables may be computer generated or hand drawn on graph paper. Each data series counts as a separate graph. A template is at [www.soinc.org](http://www.soinc.org).
    - iii. Example calculations showing how to use the graphs/tables to adjust the device for a target position.
  - b. The team must indicate up to four graphs/tables to be scored, otherwise the first four provided are scored.
  - c. All pages of the design log must be affixed together, such as via three ring binder, staples, or paperclips.
  - d. Design logs will be returned to the team after they are done competing.
5. **THE COMPETITION:**
  - a. Each team will have 8 minutes to set up, adjust and calibrate their device, and to launch a max of 2 shots with each counterweight. Measurement time required by the supervisor is not included in the allotted time. Devices that do not meet the construction specs will not be allowed to launch until brought into spec.
  - b. When instructed by the event supervisor(s), teams must place their device at a location they select in the launch area. Competitors must not be within 75 cm of the launch area or in front of the front edge of the launch area during a launch. They may touch only the part of the triggering device that extends at least 75cm outside of the launch area.
  - c. Teams may move devices within the launch area and/or adjust them in any way between and before shots.

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**STORM THE CASTLE (CONT.)**



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- d. No part of the launch device may extend outside of the launch area before or after a shot. If part of the launching device extends beyond the launch area during the launching action, it must return to and remain in the launch area immediately after the launch without assistance of the competitors.
  - e. Before the first launch with each counterweight, the team must notify the supervisor of the desired position of the target (only 0.5 m increments allowed).
  - f. Before each launch, teams must notify the event supervisor. Any launch, even if unintended or not announced, will count as one of the four launches allowed to a team.
  - g. If the team tries to trigger the device and it does not go through a launch motion, it does not count as one of the team's four launches and the team must be allowed to adjust/reset the device if time allows.
  - h. After each launch the event supervisor will indicate to the team when they may approach the target to make measurements to calibrate their device.
  - i. If a team hits the target, they may request the target be moved to a new location (in 0.5 m increments).
  - j. Supervisors must be responsible for retrieving projectiles and returning them to the team between each launch if less than 2 projectiles of each type are initially provided to the team.
  - k. The supervisor will review with the team the data recorded on their scoresheet.
  - l. Teams who wish to file an appeal must leave their device and design log with the event supervisor.
6. **COMPETITION AREA:**
- a. The launch area is a rectangular area 1.0m wide by 1.0m long (parallel to the launch direction), designated by tape on the floor. Tape must also be placed 75cm away from the sides and back of the launch area. Supervisors are recommended to use hard surfaces for the floor (e.g., concrete, hardwood, plywood).
  - b. The target will be an open-topped container with a minimum dimension of 20 cm x 20 cm x 20 cm.
  - c. The supervisor will set the target at a distance selected by the team so that two sides of the target are parallel with a straight line from the center of the Launch Area to the center of the target.
  - d. The 2 separate counterweights must consist of a 0.5-1.5 kg (light) or 1.5-2.5 kg (heavy) mass with a standard 1" open hook bolt on top. Each hook and counterweight together must fit inside a 15.0 cm cube.
  - e. Projectiles must have a mass of 20.0-40.0 g (for the light counterweight) and 40.0-60.0 g (for the heavy counterweight) and must be approximately spherical with a diameter not exceeding 6.0 cm. Dangerous projectiles must be avoided. If multiple projectiles are used, they must be similar in size, shape, and mass.
  - f. Target, counterweight, and projectile dimensions and specifications must be announced only after impound is over and must be the same for all teams.
7. **SCORING:** A scoring spreadsheet is available at [www.soinc.org](http://www.soinc.org)
- a. High score wins. Final Score = Best Light LS + Best Heavy LS + CS.
  - b. Launch Score (LS) =  $TD - 3 \times AS + B$ . Lowest possible LS is 0
  - c. Target Distance (TD) = distance, in cm, from the center of the front of the launch area to the target center.
  - d. Accuracy Score (AS) = straight line distance, in cm, from the projectile initial impact location to the target
    - i. Eligible impact locations include the floor, wall, support column, target, or other objects. The ceiling and objects affixed to or hanging from it are not eligible impact locations. Shots with projectiles hitting such areas will use the next eligible impact location contacted by the projectile.
    - ii. If the projectile hits the target on initial impact AS = 0.
  - e. Bonus (B) = Hitting the target at first impact is worth 0.15 x TD points. Making contact with the inside bottom surface is worth an additional 0.15 x TD points (for a total of 0.30 X TD points).
  - f. Chart Score (CS) - One of the submitted graphs and/or tables, selected by the event supervisor, must be scored per items i., ii. and iii. below. Partial credit may be given. Max possible CS is 40.
    - i. 6 points for including data spanning at least one variable range listed in 4.a.ii.
    - ii. **6 points for including at least 10 data points in each data series**
    - iii. 6 points for proper labeling (e.g., title, team name, units)
    - iv. 3 points for each graph or table turned in (up to 12 points total as long as they are not the same)
    - v. 5 points for including a labeled device picture or diagram
    - vi. 5 points for including at least 2 example calculations
  - g. If a team violates any THE COMPETITION rules, their LS scores will be multiplied by 0.9.
  - h. If any CONSTRUCTION PARAMETERS violation(s) are corrected during the allotted competition period, or if the team misses impound, their LS scores will be multiplied by 0.7.
  - i. Teams disqualified for unsafe operation or that do not having a device that is brought into specs during the allotted competition period will have LS scores of 0.
  - j. Participants will be informed before the next launch if they have received a penalty.
  - k. Tiebreakers: 1<sup>st</sup>: best LS; 2<sup>nd</sup> second best LS; 3<sup>rd</sup> third best LS

**GENERAL RULES**

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.

**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](http://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](http://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 B Chemistry Events. 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:			
	Crime Busters	Can't Judge a Powder	Food Science	Potions and Poisons
<b>Box</b> - Containing all of the kit materials	X	X	X	X
<b>10 ml Graduated Cylinder</b> - Measuring volumes		X	X	X
<b>25 ml Graduated Cylinder</b> - Measuring volumes		X	X	X
<b>100 ml Graduated Cylinder</b> - Measuring volumes		X	X	X
<b>50 ml Beakers</b> - Doing reactions, developing chromatograms	X	X	X	X
<b>100 ml Beakers</b> - Doing reactions, developing chromatograms		X	X	X
<b>250 ml Beakers</b> - Doing reactions, developing chromatograms		X	X	X
<b>400 ml Beakers</b> - Doing reactions, developing chromatograms	X	X	X	X
<b>50 ml Erlenmeyer Flasks</b> - Doing reactions		X	X	X
<b>125 ml Erlenmeyer Flasks</b> - Doing reactions		X	X	X
<b>250 ml Erlenmeyer Flasks</b> - Doing reactions		X	X	X
<b>Test Tubes</b> - Mix Chemicals, heat chemicals	X	X	X	X
<b>Test Tube Brush</b> - Clean Test Tubes	X	X	X	X
<b>Test Tube Holder</b> - Holds test tubes for heating	X	X	X	X
<b>Test Tube Rack</b> - Hold Test Tubes	X	X	X	X
<b>Petri Dishes</b> - Doing reactions, developing chromatograms	X	X	X	X
<b>Spot Plates</b> - Doing reactions in semi-micro scale, testing solubility, pH	X	X	X	X
<b>Slides</b> - To put hairs, crystals, or fibers on for use with a microscope	X			
<b>Cover Slips</b> - To prevent items from coming off slides	X			
<b>Droppers</b> - Add small amounts of liquids to reactions	X	X	X	X
<b>Spatulas or spoons</b> - Getting small amounts of solids out of containers	X	X	X	X
<b>Stirring Rods</b> - Stirring mixtures	X	X	X	X
<b>Thermometer</b> - Determining the temperature of a solution		X	X	X
<b>Metal Tongs, Forceps, or Tweezers</b> - Holding objects, retrieving objects from liquids	X	X	X	X
<b>pH or Litmus paper</b> - Test acidity or alkalinity of solution	X	X	X	X
<b>Hand Lens</b> - Magnification of small items for identification	X	X		
<b>9V or less Battery Conductivity Tester</b> - Determining ionic strength of solution		X	X	X
<b>Paper Towels</b> - Cleaning	X	X	X	X
<b>Pencil</b> - Writing, Marking Chromatogram	X	X	X	X
<b>Ruler</b> - Measuring lengths	X	X	X	X
<b>Magnets</b> - 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](http://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](http://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](http://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