

**BOOMILEVER**

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



1. **DESCRIPTION:** Teams will design and build a Boomilever meeting requirements specified in these rules to achieve the highest structural efficiency.

**A TEAM OF UP TO:** 2    **IMPOUND:** NO    **EYE PROTECTION:** B    **EVENT TIME:** 6 minutes

2. **EVENT PARAMETERS:**

- Each team is allowed to enter only one Boomilever, built prior to the competition.
- All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without proper eye protection will not be allowed to compete and be placed in Tier 3.
- Participants may NOT bring any equipment such as levels or squares.
- The Event Supervisor will provide the Test Apparatus (see Section 5) and tools/materials for measurement.

3. **CONSTRUCTION PARAMETERS:**

- The Boomilever must be a single structure with no separate, **loose, sliding**, or detachable pieces, constructed of wood, and bonded by adhesive. No other materials are permitted.
  - Wood is defined as the hard, fibrous substance making up the greater part of the stems, branches, trunks, and roots of trees beneath the bark. Wood does NOT include: bark, particleboard, wood composites, bamboo or grasses, paper, commercially laminated wood (i.e. plywood), or members formed of sawdust, **wood shavings**, and adhesive. Wood may never be painted, **soaked or coated in glue**, color enhanced, or have tape/preprinted/paper labels affixed. Ink barcodes or markings from the construction process may be left on the wood.
  - There are no limits on the cross-sectional sizes of individual pieces of wood. Wood may be laminated by the team without restriction.
  - Adhesive is a substance used to join two or more materials together and may be used only for this purpose. Any commercially available adhesive may be used (e.g., glue, cement, cyanoacrylate, epoxy, hot melt, polyurethane, and super glues). Adhesive tapes are not allowed.
- The Boomilever must be designed to attach to the Testing Wall (5.a.) using the Mounting Hook.
- The Boomilever must be designed to support the Loading Assembly (5.b.) so that the loading point (the centerline of the chain) is between 40 cm and 45 cm from the Testing Wall.
- Before and throughout loading, no portion of the Boomilever may touch the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.).
- 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).

4. **THE COMPETITION:**

**Part I: Check-In**

- The team must present their Boomilever for inspection & measurement.
- The team must place their Boomilever on the scale so the Event Supervisor can determine the mass, in grams to the nearest 0.01 g or best precision available.
- The team must submit their Estimated Load Supported (4.Part II.h.) to be used as a tiebreaker.
- No alterations, substitutions, or repairs may be made to the Boomilever after the check-in process has started.
- Prior to Part II: Testing, the Event Supervisor will verify that the combined mass of the Loading Assembly and sand is at least 15,100 g, but no more than 15,200 g.

**Part II: Testing**

- Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
- Participants will have 6 minutes to setup and test their Boomilever to maximum load or failure.
- The participants must place the Boomilever on the Testing Wall and assemble the Loading Assembly as required to load the Boomilever. If necessary, participants may disassemble & reassemble the Loading Assembly but must not adjust the Mounting Hook. **If the Loading Assembly is disassembled & reassembled it must retain the original sequence with no loose pieces and the opposing force must always be on the bottom of the Loading Block.** The bucket must be mounted to allow enough clearance above the floor for the bucket to tilt or the Boomilever to deflect.

**BOOMILEVER (CONT.)**

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- d. The participants will be allowed to adjust the Boomilever until they start loading sand. Once loading of sand has begun, the Boomilever must not be further adjusted.
  - e. Prior to loading, the Event Supervisor will verify that the Boomilever is placed properly:
    - i. Only attached to the Testing Wall by the Mounting Hook. **This attachment must be a pulling force on the inside radius of the J-bolt. The Boomilever may not thrust back against the wall during loading.**
    - ii. The loading point (3.c.) is between 40 cm and 45 cm from the Testing Wall as measured horizontally to the centerline of the chain (5.a.iv.).
    - iii. No portion of the Boomilever touches the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line.
  - f. Participants will load the sand into the bucket and be allowed to safely and effectively stabilize the bucket from movement caused by sand loading. Direct contact with the bucket by participants is NOT allowed. The bucket may only be stabilized by using the tips of the provided Bucket Stabilizing Sticks (5.d.).
  - g. Loading stops immediately when the Boomilever touches the Testing Wall between the Contact Width Lines (5.a.v.) or below the Contact Depth Line (5.a.iv.), failure occurs, or time expires. Failure is defined as the inability of the Boomilever to carry any additional load, or if any part of the load is supported by anything other than the Boomilever. Incidental contact of the chain/eyebolt with the Boomilever is not failure.
  - h. Once loading stops, any parts of the Boomilever in the bucket will be removed. The Load Supported (mass of the Loading Assembly and the sand in the bucket) will be recorded to the nearest gram or best precision available. The minimum Load Supported is the mass of the Loading Assembly. The maximum Load Supported is 15,000 g.
  - i. At the Event Supervisor's discretion, more than one Test Apparatus may be used. Teams may be given a choice of which apparatus they will use.
  - j. The Event Supervisor will review with the team the data recorded on their scoresheet.
  - k. Teams who wish to file an appeal must leave their Boomilever with the Event Supervisor.
5. **TEST APPARATUS:**
- a. The Testing Wall must be as follows:
    - i. Vertical, solid, and rigid surface at least 40.0 cm wide x 30.0 cm high. Constructed of ¾" grade plywood or other suitable material, with a smooth, hard, low friction surface that does not bend when loaded.
    - ii. The Mounting Hook must be a 4" steel J-bolt made of ¼" nominal round stock, have a 5/8" nominal inside hook diameter with a threaded ¼" mounting end [e.g., National Hardware barcode stock number N232-892 (UPC 038613228917), ¼" by 4" or exact equivalent shall be used].
    - iii. The Mounting Hook must be attached to the Testing Wall by the Event Supervisor with the "opening" up and installed to allow 2.5 cm +/- 0.1 cm clearance between the wall and the closest edge of the Hook. The Hook must be secured in place with a hex nut and flat washer on the front side and a wing nut and flat washer on the back side of the Testing Wall. The Hook must be approximately 5.0 cm below the top of the Testing Wall and halfway between the sides. **The hex nut and washer on the front side of the Testing Wall are considered part of the Testing Wall.** The horizontal and vertical centerlines of the hole must be marked on the face of the Testing Wall.
    - iv. A horizontal Contact Depth Line must be clearly visible on the Testing Wall. It must be drawn 20 cm for Division B or 15 cm for Division C below the center of the hole for the Mounting Hook.
    - v. Two vertical Contact Width Lines must be clearly visible on the Testing Wall. They will be drawn 4.0 cm to the right and left side of the center of the hole for the Mounting Hook, **from the top of the Testing Wall to the horizontal Contact Depth Line.**
  - b. The Loading Assembly will consist of:
    - i. A square Loading Block measuring 5 cm x 5 cm x approximately 2 cm high with a hole no larger than 8 mm drilled in the center of the 5 cm x 5 cm faces for a ¼" threaded eyebolt
    - ii. ¼" threaded eyebolt (1" nominal eye outside diameter), minimum 2 ¼" length to a maximum 4 ½" length, and a ¼" wing nut. **The loading block must be mounted on the eye bolt and be trapped between the "eye" of the eye bolt and the wing nut. The loading block cannot sit on top of the wing nut or be loose.**

## BOOMILEVER (CONT.)



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- iii. A chain and S-hook that are suspended from the eyebolt on the Loading Block
  - iv. An approximately five-gallon plastic bucket with handle and hook to be suspended from the chain
  - v. The total combined mass of the Loading Assembly may not exceed 1.5 kg
  - c. Sand: sand or other clean, dry free-flowing material.
  - d. Two (2) Bucket Stabilizing Sticks each made from a piece of ½” dowel approximately 18 inches long with a spring-type door stop screwed into one end. Refer to example on [www.soinc.org](http://www.soinc.org).
6. **SCORING:**
- a. High score wins. Score = Load Score (g)/Mass of Boomilever (g).
  - b. The Load Score = Load Supported (4.Part II.h) + Bonus.
  - c. Boomilevers that have a Load Supported of 15,000 g will earn a Bonus of 5,000 g.
  - d. Boomilevers will be placed in three tiers as follows:
    - i. Tier 1: Holding any load and meeting all construction parameters and competition requirements
    - ii. Tier 2: Holding any load with any violations of the construction parameters and/or competition requirements
    - iii. Tier 3: Unable to be loaded for any reason (e.g., cannot accommodate or hold Loading Assembly, failure to wear eye protection) and will be ranked by lowest mass
  - e. Ties are broken as follows:
    - i. Estimated Load Supported closest to, without exceeding, the actual Load Supported
    - ii. Lowest Boomilever mass
  - f. Example score calculations:
    - i. Boomilever 1: mass = 10.12 g, Load Supported = 12,134 g; Score = 1,199
    - ii. Boomilever 2: mass = 12.32 g, Load Supported = 15,000 g + Bonus = 5,000 g = 20,000 g; Score = 1,623

Recommended Resources: The Science Olympiad Store ([store.soinc.org](http://store.soinc.org)) carries the Boomilever Video Download and Problem Solving/Technology CD; other resources are on the event page at [soinc.org](http://soinc.org).

**This event is sponsored by ArcelorMittal**

**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 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
<b>Box</b> - Containing all of the kit materials	X	X	X	X
<b>10 ml Graduated Cylinder</b> - Measuring volumes	X		X	
<b>25 ml Graduated Cylinder</b> - Measuring volumes	X		X	
<b>100 ml Graduated Cylinder</b> - Measuring volumes	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	X
<b>250 ml Beakers</b> - Doing reactions, developing chromatograms	X	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	
<b>125 ml Erlenmeyer Flasks</b> - Doing reactions	X		X	
<b>250 ml Erlenmeyer Flasks</b> - Doing reactions	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	
<b>Test Tube Rack</b> - Hold Test Tubes	X	X	X	X
<b>Spot Plates</b> - For semi-micro scale reactions, testing solubility, pH	X	X	X	
<b>Petri Dishes</b> - Doing reactions, developing chromatograms	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 cover & 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>Metal Tongs, Forceps, or Tweezers</b> - Holding & retrieving objects	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>pH or Litmus paper</b> - Test acidity or alkalinity of solution	X	X	X	
<b>Hand Lens</b> - Magnification of small items for identification		X		
<b>Flame Loop</b> - For identification of ions in a compound		X		
<b>Cobalt Blue Glass</b> - To filter out any sodium that might contaminate flame test from hands		X		
<b>Filter Paper</b> - Filter solids from liquids	X		X	
<b>Funnel</b> - Hold Filter Paper	X		X	
<b>9V battery</b> - Electrolysis	X		X	X
<b>Alligator Clip Wires</b> - Connecting meters to metals	X		X	X
<b>Nail</b> - Electrolysis	X		X	X
<b>Piece of Cu metal</b> - Electrolysis	X		X	X
<b>Piece of Zn metal</b> - Electrolysis	X		X	X
<b>Multimeter</b> - Measuring current, voltage, and resistivity	X		X	X
<b>9V or less Battery Conductivity Tester</b> - Determining ionic strength of solution	X	X	X	X
<b>Calipers-mechanical, not digital</b> - Measuring lengths very precisely	X			X
<b>Paper Towels</b> - Cleaning	X	X	X	X
<b>Pencil</b> - Writing, Marking Chromatogram		X		
<b>Ruler</b> - Measuring lengths		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