

Consult the Junkyard Challenge Core Rules in the Coaches or Students Manual for additional rules and definitions that apply to this event.

Tipping the Scale

Primary Challenge

1. **The Challenge:** Build an Autonomous Device (AD) and demonstrate it by measuring the mass of the Challenge Object. Deliver the measurement to the judges within 5 minutes.
2. **Variable Parameters:**
 - a. The Challenge Object will be no larger than 10.0cm x 10.0cm x 10.0cm for the Regional Tournament, 25.0cm x 25.0cm x 25.0cm for the State Tournament, and 25.0cm x 25.0cm x 100.0cm for the National Tournament.
 - b. Its mass will be between 100.0g and 500.0g for the Regional Tournament, 10.0g and 1000.0g for the State Tournament, and 10.0g and 2000.0g for the National Tournament.
 - c. The Challenge Object will be revealed after impound. Students may not touch the Challenge Object until ready to demonstrate their AD.
 - d. The Final Directions will include the precision of the official mass of the Challenge Object (10g, 1g, 0.1g, etc.).
3. **Supplied Materials:**
 - a. One Challenge Object and one Post-it® Note or equivalent for reporting results.
 - b. At the National Tournament only there may be more than one Challenge Object.
4. **Mystery Material:** Yes. At the National Tournament only there may be more than one.
5. **Prohibited Materials:**
 - a. Commercial scales, components of commercial scales. Students must be able to demonstrate that their components did not come from a commercial scale.
 - b. Commercially calibrated weights and masses are prohibited as construction materials but may be used as tools.
6. **Construction Time:** 30-45 min. (exact time announced prior to competition or during Final Instructions).
7. **Demonstration:**
 - a. Students will install the Challenge Object in their device.
 - b. If the AD is activated by the students prior to scoring, timing will begin when the Challenge Object is released. Otherwise timing will begin when the AD is activated.
 - c. Students then have up to 5.00 minutes to deliver their written mass estimate to the judges on the provided Post-it® Note.
 - d. Timing stops when transfer of the estimate is complete. Once transferred, the estimate is final. If the estimate has more precision than the official mass, the judges will truncate it to the expected precision.
 - e. To qualify for tiers 1 and 3, students must demonstrate to the judges that their AD actually measures weight or mass and explain how the reading on their AD corresponds to their estimated mass.
 - f. Students may not simply estimate the mass of the Challenge Object by visual inspection or guessing. Tables, graphs and calculators may be used to interpret the AD's mass reading, but the AD itself may not be touched after timing begins.
8. **Scoring:**
 - a. Estimated Mass = the mass of the Challenge Object in grams as cited by the students
 - b. Official Mass = the mass of the Challenge Object in grams as cited by the judges
 - c. Height = distance in cm between the highest point of the AD and the lowest surface on which it rests
 - d. Length = longest horizontal dimension of the AD in centimeters
 - e. Time = the number of whole seconds from start of timing to transfer of estimate, rounded down
 - f. Tier 1 and 3: Ranked by $|Official\ Mass - Estimated\ Mass|$ *Low score wins tier 1 and 3*
 - g. *If two Challenge Masses:* $|Official\ Mass1 - Estimated\ Mass1| + |Official\ Mass2 - Estimated\ Mass2|$
 - h. Ties in tiers 1 and 3 will be broken by Time (low score wins), then by Height (high score wins).
 - i. Tier 2 and 4: Ranked by Height, then by Length. *High scores win tier 2 and 4.*
 - j. Each touch will result in a 10% score penalty per touch.