

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 $| \text{Official Mass} - \text{Estimated Mass} |$ *Low score wins tier 1 and 3*
 - g. *If two Challenge Masses:* $| \text{Official Mass1} - \text{Estimated Mass1} | + | \text{Official Mass2} - \text{Estimated Mass2} |$
 - 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.

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Coin Sorter

Alternate Challenge

1. **The Challenge:** Build an Autonomous Device (AD) capable of sorting five dollars of mixed pocket change into separate bins, each containing one kind of coin, within one minute. To qualify for tiers 1 and 3, the AD must successfully sort at least one coin of each denomination.
2. **Additional Specifications:**
 - a. Each coin bin on the AD must be clearly marked with the denomination of the coins it will hold, and must allow access to coins for scoring.
 - b. All coins must enter the AD through the same opening (Coin Opening).
 - c. State Tournament: change may be loaded into a hopper prior to demonstration, poured into the device during demonstration or hand-fed during demonstration. The AD may be touched as required for hand feeding but not otherwise influenced, adjusted or controlled.
 - d. National Tournament: change may only be loaded into a hopper prior to demonstration or poured into the AD during demonstration – no hand feeding.
3. **Variable Parameters:**
 - a. The number of each type of coin will be determined by the judges such that the total value equals five dollars.
 - b. Only quarters, dimes, nickels, and pennies will be used.
4. **Supplied Materials:** Five dollars in mixed pocket change.
5. **Mystery Material:** Yes. At the National Tournament only there may be more than one.
6. **Prohibited Materials:** Commercial coin sorting machines, components of commercial coin sorting machines.
7. **Construction Time:** 30-45 min. (exact time announced prior to competition or during Final Instructions).
8. **Demonstration:**
 - a. The AD may be turned on prior to demonstration.
 - b. Students will have one minute to feed and sort as much of the change as possible using their AD.
 - c. Change may not be sorted prior to loading, pouring or feeding.
 - d. If coins are preloaded, timing will start when the AD is activated. Otherwise timing begins when the first coin is fed. If finished before one minute has elapsed, students must shout "Stop" to gain bonus seconds.
 - e. At the end of 60.0 seconds all sorting must stop and no more coins may enter the coin containers.
 - f. To qualify for tiers 1 and 3, students must demonstrate to the judges that their AD actually sorts coins and all locations or containers for each denomination of coins must be clearly labeled prior to the end of construction.
9. **Scoring:**
 - a. Total Value = Total value in cents of all change accurately sorted.
 - b. Height = Distance between the lowest point of the Coin Opening and the surface on which the AD rests, rounded to the nearest cm
 - c. Length = Longest horizontal dimension of the AD in centimeters, rounded to the nearest cm
 - d. Bonus Seconds = Seconds remaining on the 60 second timer, rounded up to whole seconds.
 - e. Tiers 1 & 3:
$$\frac{[(100 - |Height - 100|) \times Total Value]}{50} + \text{Bonus Seconds (high score wins)}$$
 - f. Ties broken by Bonus Seconds, then by Length
 - g. Tiers 2 & 4: Ranked by Height, then by Length. (high score wins)
 - h. Ties Broken by Height, then Length
 - i. Each touch will result in a 10% score penalty per touch.