

Fermi Questions (30 Minutes - Based on Team Schedule)

Description: This event tests participants' ability to provide rough estimates of a quantity to a series of Fermi Questions.



Participants per Team: 2

Spirit of the competition:

- It is a rules violation if coaches, parents, mentors, or spectators enter the competition area. Talking to the team members any time during the competition. Violation of this rule will place the team below all other teams.

Teams need to bring: Pencils, and Scrap paper. A four-function calculator is a big must.

Safety Requirements: None

The Competition:

In physics or engineering education, a Fermi problem (or Fermi quiz, Fermi question, Fermi estimate), also known as order-of-magnitude problems (or order-of-magnitude estimate, order estimation), is an estimation problem designed to teach dimensional analysis or approximation of extreme scientific calculations, and such a problem is usually a back-of-the-envelope calculation.

- Example of a Fermi question: How many pennies would it take to make a stack the height of Mt. Everest? The students will be given the height of Mt. Everest but will not receive the thickness of a penny.
- The Event Supervisor will provide not commonly known values, namely distance between the US & Australia or how much an aircraft carrier weighs. The students are however expected to estimate measurements of things they come across on a daily basis, namely the thickness of a penny or paper.

All answers are to be written to the correct power of ten (exponent) as follows:

- For a number in the form $C \times 10^E$, the guide for rounding of the coefficient (C) is: if C is 5 or greater (to 9.99...), round C up to 10. For example, if the number is
- 5.001×10^3 , the correct power of ten is 4. Responses recorded as 5.001×10^3 will be
- marked as incorrect. If C is below 5 (and greater than 1), round C down to 1. For example, if the number is 4.99×10^6 , you record 6 as your answer.
- Positive exponents are the default. For negative exponents, the minus (-) sign must be included in the answer. If the number is 1.5×10^{-3} , the correct power of ten is -3.

Students may be asked questions related to these units:

- Length - Common units of length in metric and standard systems, including inch, foot, yard, furlong, rods, and chains
- Mass - Common units of mass in metric and standard systems, including ounce, pound, tons, milligrams, grams, kilograms, and metric tons
- Time - Millennium, Century, Score, Decade, Year, Month, Day, Hour, Minute, Second, Millisecond.
- Volume - Common units of volume in metric and standard systems, including milliliters, liters, cubic meters, cubic centimeters, gallons, quarts, pints, cups, tablespoons, and standard barrels
- The Event Supervisor will give the students a formula/conversion sheet of any uncommon measurements for this test.

Scoring:

Method of scoring - Points are scored if the response is:

- Equal to the accepted value: 5 points
- ± 1 of the accepted value: 3 points
- ± 2 of the accepted value: 1 point

High score wins.

Tiebreakers:

- Ties are broken by counting the highest number of answers that receive five (5) points. If the number of 5-point answers is the same, the number of 3-point answers will be used. Time is used as the third tiebreaker, if needed.

Possible Resources:

Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events. The listed resources are meant as a starting point. It is up to the competitor to research further.

- [Fermi Questions](#) from Scioly.org
- [Fermi Questions](#) from Science Olympiad