



Rules For Fermi Questions

Objective

A "Fermi question" is a question in physics that seeks a fast, rough estimate of quantity that is either difficult or impossible to measure directly.

For example: Assume a question is: How many dollar bills in a stack of dollars 10 miles high? We assume: dollars are as thick as copy paper and 500 sheets of copy paper are about 2 inches high. Then the math: $(10 \text{ miles})(5000 \text{ ft/mi})(10 \text{ in/ft})(500 \text{ sheets}/2 \text{ in}) = 12.5 \times 10^7$ or 1.25×10^8 . (Note: If one used more precise conversions and a calculator, you would get 3.16×10^8 , still magnitude 10^8 .)

Grading

Teams will select the best order of magnitude value for each question from a list of 15 possible answers.

Possible answers for the above question might include the following:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

The team should neatly draw an "X" on their answer sheet through "8" because 1.25×10^8 is best approximated by 10^8 , (We are marking only the exponent of 10.) All questions should be marked according to this general scheme.

Participants

Teams of two members are permitted with a maximum of two teams per school. There will be a maximum of 30 teams.

Materials

One envelope of Fermi Questions; pencils, paper, and answer sheet. Participants may use no calculators or any other electronic devices.

Rules

1. The first 30 teams lined up will participate. Your school team will be seated on the floor.
2. A single answer sheet will be provided and time allotted to fill in required information.
3. All teams will receive an envelope containing two blank sheets of paper, two pencils, and the same 10 Fermi questions on two separate sheets of paper, one for each team member. The sequencing of questions may vary from team to team.
4. Only when directed to do so, will teams open the envelope and begin answering the questions. Teams will be given 20 minutes to answer as many questions as possible, marking appropriate answers on the provided answer sheet.
5. Judges will advise periodically of time remaining. When judges indicate time is up, all marking of answers must cease or the team will be disqualified.
6. Answer sheets will be collected and scored as follows:
 - 5 points for the correct exponent
 - 3 points for the correct exponent ± 1
 - 1 point for the correct exponent ± 2
7. Announcement of the top three scoring teams will be made as soon as possible. Additional Fermi questions will be used to break ties.
8. Teams will be disqualified for "sharing" any information with other teams.

There are purposely more questions than can be easily answered within this time limit. However you will answer more of them if you concentrate on estimating quantities, rather than trying to calculate them exactly.