

DESCRIPTION:

A "Fermi Question" is a science related question that seeks a fast, rough estimate of a quantity, which is either difficult or impossible to measure directly. For example, the question "How many drops of water are there in Lake Erie?" requires an estimate of the volume of a drop, the volume of Lake Erie from its approximate dimensions and conversion of units to yield an answer. The answers should be an estimate within an order of magnitude recorded in power(s) of ten

EVENT PARAMETERS: Calculators, computers, slide rules, reference sheets, etc., are **NOT** allowed. Bring pencils. Teams are allowed to finish before the allotted time: they should hand in their answer sheet, have the time recorded by the event supervisor, and exit the room quietly.

A TEAM OF UP TO: 2 **APPROXIMATE TIME: 50 minutes**

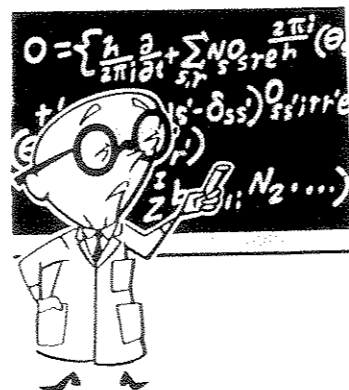
THE COMPETITION:

1. Each team will have about 50 minutes to answer as many questions as possible.
2. All Teams will be quizzed together and will be given no feedback on point counting during the question.
3. One teammate will be designated to serve as the team captain and will indicate on the score sheet the team's answers.
4. All answers are to be written to the nearest integral power of ten (exponent). For example, if the number is 1.4×10^6 , you record 6 as your answer. If it is 8.6×10^3 , you record 4. Responses recorded as 8.6×10^3 on the answer sheet will be marked as incorrect.

SCORING:	If the response is:	It earns:
	equal to the accepted value	5 points
	± 1 of the accepted value	3 points
	± 2 of the accepted value	1 point

Example: If the accepted value is seven and the response given is 7; then five (5) points are awarded. A response of 6 or 8 receives three (3) points and a response of 5 or 9 receives one (1) point. 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, time is used as the second tiebreaker.

Possible Resources: **The Lore of Large Numbers** by Philip J. Davis (Paperback - July 1978)
See for lessons and examples: <http://www.soinc.org/fermiq/index.htm>



DESCRIPTION: Students will be asked to answer questions and perform experiments pertaining to food chemistry. This event will consist of a laboratory part and written question part. These questions will be at stations in the event as well as the laboratory activities.

SAFETY REQUIREMENTS: Students must wear the following or they will not be allowed to participate: close-toed shoes, OSHA approved chemical splash goggles with indirect vents, pants or skirts that cover the legs to the ankles and a lab coat or apron that reaches below the knees. Gloves are optional. Students who unsafely remove their safety clothing/glasses or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) would be disqualified from the event. **EVENT PARAMETERS:** The students must supply a calculator and pencil. The event supervisors will supply all other necessary materials, equipment, and reagents.

A TEAM OF: up to 2

APPROXIMATE TIME: 50 minutes

THE COMPETITION: Foods are made up of at least three major food groups or classes of compounds: carbohydrates, proteins, and lipids. At each station, students will be asked to perform a laboratory task and/or answer written questions about food chemistry. The competition will consist of a series of stations that include activities similar to those in first year high school science courses. These stations could include hands-on activities, interpretation of experimental data (graphs, diagrams, etc.), and/or observation of an experiment set up and running. Supervisors are encouraged to use computer or calculator sensors/probes wherever possible or provide students with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in a tabular and/or graphic format and students will be expected to interpret the data. All measurements must be recorded with correct significant figures and units. All calculations must also include correct significant figures and units. Stations might include the following topics or activities: simple tests for proteins, lipids, and various carbohydrates. Absolutely no reference materials, scientific instruments, or other resource materials will be admitted.

SAMPLE TASKS AND LABORATORY EXPERIMENTS:

- ◆ When given several food samples, students will be expected to distinguish between lipids, carbohydrates and proteins using typical reagents such as Benedict's solution, Biuret solution, Lugol's iodine, etc.
- ◆ Explain how the reagents work in order to identify the different foods, e.g., the reaction involved.
- ◆ When given generic structural formulas for each major food group, students will properly distinguish between the three food groups.
- ◆ Based on the general structure of an amino acid, explain why they have acidic and basic characteristics and how this is involved in forming the protein.
- ◆ When given samples of sugars, students will properly identify the sugar as reducing or non-reducing sugars, and/or monosaccharide or polysaccharides.
- ◆ When given a food sample, students will experimentally determine the caloric value of the foodstuff. Reference for calorimeter: <http://www.woodrow.org/teachers/chemistry/institutes/1988/foodheat.html>
- ◆ When provided with a food sample such as popping corn, students will determine the amount of moisture in a known sample.
- ◆ Determine the density of a food sample.

SCORING: The laboratory part of the activity will count at least 75% of the total points. The remaining 25% will be based on the questions, which will be at some of the stations. Points will be awarded for correct answers and/or proper techniques. Cleanup must occur after all laboratories are completed and failure to do this will result in a penalty. All measurements and calculations must be recorded in the correct significant figures and units. All ties will be broken by selected questions chosen by the supervisors. These questions will not be identified to the students. Possible References: Flinn: Chemistry of Food (AP4274), Chemistry of Food Additives (AP4275), and Chemistry of Beverages (AP4282).