



YALE
PHYSICS
OLYMPICS



Fermi Quiz

Aim: To estimate the values of various quantities.

Materials: None - except an imaginative, innovative mind.

Method: For each of the 15 questions listed on the attached sheets, estimate the closest power of 10 associated with the quantity in question.
Mark the most appropriate "multiple-choice" answer - A, B, C, D, or E.

When you have completed the quiz, enter your results electronically using the system in room SPL-57, as describe in the attached sheet.

Conditions: The answers must be entered in the units specified.

Time Limit: Your results must be entered by **1:30** - before the beginning of Event #4.!

Ranking: The ranking order will be determined the sum of your marks on all of the questions. The Lowest sum gets the highest ranking, etc.
[The correct answer is given a mark of 1, the answer next closest to the correct one is given a mark of 2, then the next next closest, a mark of 3, etc.]

Examples: If your estimate is 550, then you should enter "3" because 550 is closer to 10^3 than to 10^2 .

If your estimate is 450, then you should enter "2" because 450 is closer to 10^2 than to 10^3 .

Fermi Questions

- 1.) How many electrons are there in your body?
 (A) 22 (B) 24 (C) 26 (D) 28 (E) 30

- 2.) How many transistors are there in the world?
 (A) 14 (B) 16 (C) 18 (D) 20 (E) 22

- 3.) How many gallons of jet fuel does a 747 airplane use crossing the Atlantic Ocean, fully loaded with passengers?
 (A) 3 (B) 4 (C) 5 (D) 6 (E) 7

- 4.) How many revolutions does a car's crankshaft make (how many strokes do the pistons make) during the time that the car travels 150,000 km. (Assume that the car is traveling at a constant 100 km/h, with the tachometer indicating a constant 2000 rpm.)
 (A) 4 (B) 5 (C) 6 (D) 7 (E) 8

- 5.) How long (in **nanoseconds**) does it take green light to cross a 100 meter wide playing field?
 (A) -1 (B) 0 (C) 1 (D) 2 (E) 3

- 6.) If Tiger Woods can hit a golf ball with a directional precision of 1 micro-radian from New Haven toward the center of the Golden Gate Bridge (San Francisco, CA - assume a distance of 5000 km), how close (in **meters**) to the center of the bridge will the golf ball land?
 (A) 1 (B) 2 (C) 3 (D) 4 (E) 5

- 7.) How high (in **meters**) would a stack of one-dollar bills be that is equivalent to the current national debt (≈ 7.3 trillion dollars)?
(A) 5 (B) 6 (C) 7 (D) 8 (E) 9
- 8.) How long (in **cm**) will your hair grow during your lifetime?
(A) 1 (B) 2 (C) 3 (D) 4 (E) 5
- 9.) How much energy (in **Joules**) would be produced in the fission of 20 grams of ^{235}U ?
(A) 9 (B) 10 (C) 11 (D) 12 (E) 13
- 10.) How many rotations has the earth made around its axis since its formation?
(A) 8 (B) 9 (C) 10 (D) 11 (E) 12
- 11.) What is the ratio of frozen water to liquid water on the earth?
(A) -2 (B) -1 (C) 0 (D) 1 (E) 2
- 12.) What is the mass lost (in **kgm**) by the sun per second due the transformation of mass to energy via $E=mc^2$?
(A) 5 (B) 6 (C) 7 (D) 8 (E) 9
- 13.) Making a *bed of nails*: If the threshold for pain is ≈ 0.1 N/nail, what the density of nails (in **nails/cm²**) should you use?
(A) -1 (B) 0 (C) 1 (D) 2 (E) 3
- 14.) What is the diameter of the moon (in **m**)?
(A) 3 (B) 4 (C) 5 (D) 6 (E) 7
- 15.) The resting human body needs to consume ≈ 1500 Calories/day to stay warm (enough to stay alive, but not enough to do any physical work). How much energy does this body radiate (in **Watts**)?
(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

FERMI QUIZ INSTRUCTIONS

SELECT THE BAG WITH YOUR TEAM'S NAME ON IT AND REMOVE THE REMOTE DEVICE.

YOU SHOULD HAVE ALREADY SELECTED YOUR ANSWERS TO THE FERMI QUIZ WHEN YOU START TO ELECTRONICALLY ENTER YOUR RESULTS. WHEN YOU ARE READY TO ENTER YOUR RESULTS, POINT THE REMOTE AT THE RECEIVER AT THE FRONT OF THE ROOM, AND PRESS THE STAR BUTTON FIRMLY AND RELEASE. THERE IS NO TIME LIMIT FOR SUBMITTING YOUR ANSWERS.

A BOX LABELED WITH YOUR TEAM'S ABBREVIATED NAME WILL APPEAR ON THE SCREEN.

NEXT TO YOUR TEAM'S NAME WILL BE A BOX WITH THE NUMBERS 1 (IN YELLOW) AND 0 (IN WHITE).

THE FIRST NUMBER (IN YELLOW) INDICATES THE QUESTION YOU ARE CURRENTLY ANSWERING. THE SECOND BOX (IN WHITE) INDICATES HOW MANY TIMES YOU HAVE ANSWERED THE QUESTION.

TO ANSWER THE FIRST QUESTION, PRESS FIRMLY (ONCE!) THE LETTER KEY CORRESPONDING TO YOUR ANSWER. THE FIRST NUMBER WILL INCREMENT TO 2 AND THE SECOND NUMBER WILL STAY AT ZERO (INDICATING YOU HAVE NOT YET ANSWERED QUESTION 2).

CONTINUE INPUTTING YOUR ANSWERS UNTIL THE FIRST NUMBER READS 1 AGAIN. THE SECOND NUMBER SHOULD NOW ALSO READ 1, INDICATING THAT YOU HAVE ANSWERED THE FIRST QUESTION ONE TIME.

YOU CAN CHECK THAT YOU HAVE INPUT ALL YOUR ANSWERS BY PRESSING THE STAR BUTTON WHICH WILL ADVANCE YOU THROUGH THE QUESTIONS. IF YOU HAVE ANSWERED ALL THE QUESTIONS THE SECOND NUMBER WILL READ 1 FOR EACH QUESTION.

IF YOU WISH, YOU CAN CHANGE YOUR ANSWER BY ADVANCING TO THE DESIRED QUESTION AND PRESSING A DIFFERENT LETTER.

WHEN YOUR TEAM HAS FINISHED SUBMITTING YOUR ANSWERS, PLACE THE REMOTE BACK IN THE BAG AND PLACE THE REMOTE INTO THE BOX PROVIDED.

IF YOU HAVE ANY PROBLEMS PLEASE LOCATE AN EVENT ORGANIZER.