

Name(s): _____

Team Name: _____

Team Number: _____

Fermi Questions

Rules:

For each question, answer the quantity as the nearest integral power of ten.

Scoring:

If the response is equal to the accepted value, it earns 5 points.

If the response is ± 1 of the accepted value, it earns 3 points.

If the response is ± 2 of the accepted value, it earns 1 point.

	Answer	Points
1. Estimate 3^{24} .		5 3 1 0
2. Estimate the volume of the North American plate in cubic meters.		5 3 1 0
3. If every person in the US stood side by side with arms outstretched to their maximum length, how long (in furlongs) would the human chain be?		5 3 1 0
4. Estimate the physical length of a base pair of DNA in meters.		5 3 1 0
5. Divide the mass of an electron by the mass of the earth.		5 3 1 0
6. Estimate 12^{13} .		5 3 1 0
7. Estimate the mass of an eukaryotic cell in grams.		5 3 1 0
8. How far (in miles) would a beam of light travel in the span of the total lifetime of the earth? (Assume the beam goes in a straight path and is uninterrupted).		5 3 1 0
9. Estimate the number of cells in a human with a mass of 70 kg.		5 3 1 0
10. Estimate the density of the earth in kg/furlongs ³ .		5 3 1 0
11. How many standard 2x2 LEGO bricks could fit in an average adult?		5 3 1 0
12. Estimate the sum of the entries of the first 50 rows (row 0 to row 49) of Pascal's triangle.		5 3 1 0
13. Estimate the land area of the earth in acres.		5 3 1 0
14. How many 100W light bulbs would it take to equal to the power output of the sun?		5 3 1 0
15. What is the value of $10^{10^{10^{10^{-10}}}}$?		5 3 1 0

16. How many quarters does it take to make a stack as tall as Mount Everest?		5 3 1 0
17. Estimate 100!		5 3 1 0
18. How many times does the average human blink in his or her lifetime?		5 3 1 0
19. Estimate the thickness of a piece of paper in micrometers.		5 3 1 0
20. Estimate the length of a baseball bat in terms of picometers.		5 3 1 0
21. In British Thermal Units, estimate the energy required to heat all the water in Lake Superior by 1°C.		5 3 1 0
22. Compute the density of an average Giant Sequoia tree in amu/pc ³ .		5 3 1 0
23. Estimate the total distance covered in game by all soccer players in the 2014 World Cup in angstroms.		5 3 1 0
24. How many people would it take to cover Alaska if everyone was standing side by side?		5 3 1 0
25. The astrophysicist Arthur Eddington once stated that the number of protons in the universe was $136 * 2^{2^8}$. Estimate this number.		5 3 1 0
26. How many digits are in the largest prime number discovered?		5 3 1 0
27. What is the molar mass of Botox in g/mol?		5 3 1 0
28. How many TI-84 calculators could fit inside the Earth?		5 3 1 0
29. Determine the speed of light in angstroms/fortnight.		5 3 1 0
30. Divide the density of the sun by the density of Venus.		5 3 1 0
31. How many Earths could fit inside of Betelgeuse?		5 3 1 0
32. If placed in a single file line, how many protons would be needed to span from London to Tokyo?		5 3 1 0
33. Divide the wavelength of a radio wave by the wavelength of an x-ray wave.		5 3 1 0
34. How many McDonalds ketchup packets are used in a year in the US?		5 3 1 0
35. Estimate the age of the universe in nanoseconds.		5 3 1 0
36. Estimate the number of deaths in World War 2.		5 3 1 0
37. Estimate the total US government debt as of 7/22/2018.		5 3 1 0
38. How many words are on this test?		5 3 1 0

Answer Key

1. 11
2. 19
3. 6
4. -10
5. -55
6. 14
7. -9
8. 22
9. 13
10. 10
11. 4 ⁽¹⁾
12. 15
13. 9
14. 24
15. 10
16. 7
17. 158
18. 9
19. 2

20. 12
21. 16
22. 79 ⁽²⁾
23. 17 ⁽³⁾
24. 13
25. 79
26. 7
27. 5
28. 24
29. 24
30. -1
31. 15
32. 25
33. 13
34. 9 ⁽⁴⁾
35. 26
36. 8
37. 13 ⁽⁵⁾
38. 3

1: <https://qph.fs.quoracdn.net/main-qimg-5dd13794a60169c02e9caf5b47aa8eea>

2: https://www.fs.fed.us/psw/publications/documents/psw_gtr151/psw_gtr151_06_knigge.pdf

3: <https://www.fifa.com/worldcup/archive/brazil2014/statistics/players/distance.html>

4: <http://www.everysecond.io/mcdonalds/>

5: <http://www.usdebtclock.org/>

The source for all other computational answers was WolframAlpha.