

# Fermi Questions

Northview Invitational

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**Directions:**

- **CIRCLE YOUR FINAL ANSWER**
- Questions without a circled answer will be given ZERO points
- You will have 50 minutes to take the exam.
- Only writing utensils and your brain are permitted.
- Your answer should be given in order of magnitude. If your answer is  $5 \cdot 10^3$ , your answer should be 3. Negative exponent, means your answer has to have a negative in it, or no points will be awarded.
- Scoring: A correct answer is worth 5 points. An answer off one order of magnitude is worth 3 points. An answer off by two orders of magnitude is worth 1 point. Any other answer is worth 0 points. If the answer is negative, you MUST put a negative symbol.
- Scoring 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 3 points and a response of 5 or 9 receives 1 point.

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1. What is the pH of rain?
2. How many times more massive is the Sun than the moon?
3. How far away is the star system 61 Cygni from the Sun in meters?
4. Evaluate  $41!$
5. How many bones are there in the human body?
6. How many atoms of gold are there in a Science Olympiad gold medal?
7. Evaluate  $8^{2020} + 6^{2020}$

8. How many seconds will it take to fully and quickly write out the number of 1 googol if you were not allowed to use scientific notation?
  
  
  
  
  
9. How many ways can you make change for a dollar?
  
  
  
  
  
10. Evaluate  $100!$
  
  
  
  
  
11. Evaluate  $2^{24}/3^{24}$
  
  
  
  
  
12. How tall, in feet, is the 22nd tallest building in the world?
  
  
  
  
  
13. What is Halley's Comet's Aphelion in feet?
  
  
  
  
  
14. How much mass, in kg, is the Sun losing every second?

15. How much gum is sold worldwide every year?
16. How many grams of plastic are thrown into the ocean every second?
17. How many Iphone XR's equal the mass of Mars's moon Phobos?
18. Evaluate  $12! \bullet 20!$
19. If every person who ever lived crowded together in one spot, how much area would be covered, in terms of the area of Rhode Island?
20. The world's 62nd largest country in terms of population in terms of the Brazilian population
21. The luminosity of an average light bulb compared to Betelgeuse when it goes supernova

22. The ratio of the volume of a dust grain compared to an Ipad Air (4th Gen)

23. How many joules will it take to combust the entire world population?

24. The distance from Point Nemo to Novi, Michigan in micrometers

25. If photosynthesis stopped at this instant, how long would it take for all the oxygen to run out in picoseconds?

26. How many humans have perished in all of humanity's wars?

27. What is the area (in  $\text{cm}^2$ ) of the leaves on a mature, healthy oak tree?

28. The ratio of the mass of water on Earth to the mass of Earth.

29. Evaluate  $39! \bullet 16^{2020}$

30. Ratio of the volume of the Empire State Building compared to Stephenson 2-18

31. How much time in seconds would it take for the world population to reach 10 billion?

32. If you were to take all the DNA from each cell of a human and uncoil it, how many human beings would you need to have DNA stretch from Mars to Earth?

33. How many toothpicks are required to cover a baseball diamond if the tooth picks are lying flat and side by-side?

34. If, when you brush your teeth, a single bristle falls off of your toothbrush every 10 seconds, how long would it take for all bristles to fall off (in hours)? Assume that you listen to your dentist.
35. An EMD SD70ACe/LW (2021 - Present) Diesel-Electric Freight Locomotive is accelerated to 75% the speed of light. How much kinetic energy would it release in ergs?
36. What about an alpha particle accelerated to 80% the speed of light?
37. How long will it take to be safe to live in Chernobyl in jiffies? (Yes this is an actual measurement of time)
38. Now how long will it take for light to travel to Barnard's Star in jiffies?
39. The ratio of the maximum speed of a MiG-25PD Foxbat-E compared to an amoeba

40. If the sun were to cease nuclear fusion, how long (in microseconds) would it shine at a constant luminosity before “burning” out?
41. The amount of time light takes to travel 1 picometer in gigaseconds
42. What is the pressure at the center of the sun, as a multiple of the standard bicycle road tire pressure?