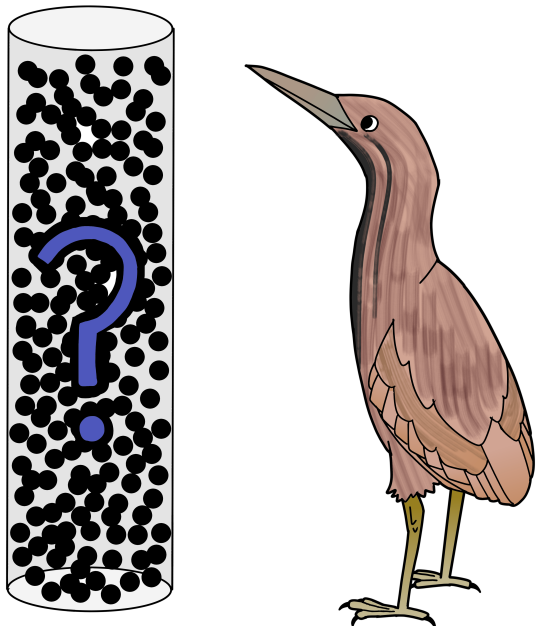
Science Olympiad
Fermi Questions C
BirdSO Invitational

March 7-13, 2021



Directions:

- Each team will be given **50 minutes** to complete the test.
- This test is composed of **60 questions**. You are not expected to answer them all.
- Answers must be given in **order of magnitude**. Each question is answered in the scientific form $\alpha \times 10^{\beta}$. If $\alpha < 5$, your answer should be β; if $\alpha \geq 5$, your answer should be $\beta + 1$. For example, if the number was 4.99×10^2, the answer would be 2; if the number was 5×10^2, the answer would be 3.
- Best of luck! And may the odds be ever in your favor.

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Feedback? **Test Code**: *2021BirdSO-FermiQuestionsC-Chickadee*

1. How many nanoseconds did it take you to read this sentence?
2. Compute (Larry Bird's Jersey #)^{100}.
3. How many years would it take to walk from the SF Bay in California ... to New York Island?
4. How many Sonic Chili Dogs (Chili Cheese Coney) would Klebb have to eat in order to replenish all the calories he burned while walking to New York?
5. How many words are on the Wikipedia page for "Bird"?
6. What is the population of China minus the population of the United States?
7. What is the average number of windows in a house?
8. How many ways can 15 unique books be arranged on a three-shelf bookcase? Assume 5 books can fit on each shelf.
9. How many atoms of gold are in one carat of 24-karat gold?
10. On average, how many packages did Amazon deliver everyday in 2019?
11. What is the distance to the sun in meters?
12. How many kilograms of gold can you buy with Elon Musk's net worth?
13. How many helium balloons do you need to lift a human being?
14. How many πgeons are there worldwide?
15. How many questions are there on this test?
16. Klebb generates a string of 10 letters, with each letter having a probability of being generated equal to that letter's relative frequency in English. What is the probability of Klebb generating the string `meadowlark`?
17. How many feathers weigh a slug?
18. How many KFC buckets filled with 12 pieces of chicken would fit inside the Earth?
19. How long is a footlong in furlongs?
20. How many fortnights of Fortnite have been played, ever?

21. What is the probability of having a negative IQ, assuming IQ's distribution is indeed normal centered at 100?

22. How loud, in W/m^2, would the Sun be to you if all of the Sun's total power output were converted completely to sound energy and you decided to stand on Mercury? Assume that empty space suddenly got filled with air ... somehow.

23. On a perfect scale, one side is occupied by a blue whale. How many blue jays would have to sit on the other side to make the scale balanced?

24. Tall Vincent stands on top of Mount Everest, and he is confused about where he is. Is he dreaming? Or is the air just so thin that he's getting lightheaded? He screams, for he does not know. His scream can be abstracted as a point source emitting sound. Assuming the Earth is completely flat aside from the mountain and he can scream loud enough, how many seconds would it take for his scream to reach the ears of his friends in New York City?

25. How many 500-mL bottles of water would be needed to fill a tub the size of Bangladesh up to 1 cm?

26. How many grams of potassium permanganate can be produced from the potassium in one apple? Assume there is infinite permanganate.

27. How many *Universe* superyachts are needed to span the observable universe?

28. How many atoms of gold are on the James Webb Space Telescope?

29. A 1 cm cube of Jell-O is smacked by a typical spoon. What is the frequency at which it vibrates, in hertz?

30. How many vegetable slices are in one serving of ratatouille in the movie *Ratatouille*?

31. How many pinheads can you glue on the surface of a pinball?

32. What is π^{19}?

33. If an AA battery is collected from every person in California, how many milligrams of aluminum can be electrolyzed from molten aluminum oxide with the total charge?

34. What is the number of shirts on the shelves of a typical Walmart?

35. How many practicing orthodontists are in Iowa?

36. How many Sverdrups is the entire global input of fresh water from rivers to the oceans?

37. Shuckle is a weak pokemon ... or is it? Under optimal conditions in a triple battle, how much damage could shuckle theoretically do in one attack?

38. How many molecules are there in Earth's atmosphere

39. How many miles of interstate highways are there in the US?

40. My friend Aidan and I decide to play rock-paper-scissors. Assuming the results are truly random, find the probability that I do not lose a single game to Aidan after 100 games.

41. Find Hubble's constant in units of hertz.

42. By what factor is the electrostatic force between a proton and electron greater than the gravitational force between the proton and electron?

43. How many barns (units) would it take to cover the floor of a barn (building)?

44. What is $10^{10^{10^{10^{-100}}}}$?

45. The Richter scale measures the strength of an earthquake, where the magnitude scales logarithmically with energy. The equation is $\log E = 11.8 + 1.5M$ where E is in ergs and M is the magnitude. How many tons of TNT would it take to release the same amount of energy as a 100 magnitude earthquake?

46. How many prime numbers p are there less than 10^{2020} such that $p + 2$ and $p + 4$ are also prime?

47. Compute (10!)!

48. How many possible teams of six Pokémon are possible made up of only Smogon's Red/Blue/Yellow OU Pokémon, considering species and four-move movesets?

49. How many trees would you have to chop in order to create enough sheets of paper folded into paper airplanes that equal the mass of the US Air Force's personnel?

50. An unfair coin lands on heads a third of the time. What is the probability to flip it 50 times and get 15 tails and 35 heads, in percent?

51. How many Straits of Gibraltar are needed to equal their net flow to the volumetric production rate of Coca-Cola drinks?

52. Your friend George has come up with an ingenious plan to create sustainable energy. He develops the Gravitational Energy Collector (GEC) which collects 100% of the potential energy of a falling object. Since he wants this to be sustainable, he decides to use the GEC in a mango orchard. How many mango trees are needed to power the entire Western Interconnection?

53. Cellulose is an extremely strong polymer. A rod of pure cellulose is fabricated with a length of 2 m and a diameter of 5 cm. If a compressive force of 7 kN is applied to its ends, how much does it contract by, in meters?

54. In a different universe, the speed of light is ten thousand times greater than the speed of light. With everything else staying the same, what is the Planck length of the other universe, in meters (from this universe)?

55. 1, 3, 3, 9, 27, 243, 6561 ... Find the 20th number in this sequence.

56. According to the holographic principle, the maximum amount of information (in bits) that can be stored in a system is proportional to the surface area. Hawking found that the maximum entropy (or information) can be found by $S = kA/4$, where k is the Boltzmann's constant (1.3×10^{-23} JK) and A is the surface area in Planck areas. Using this equation, how many times more information can a human body theoretically hold than the human body already holds through the storage of DNA? Assume there are 40 trillion human cells that contain DNA.

57. If human beings give off infrared light with a wavelength of 1 mm, how many photons will the entire current population of the earth give off in 1 galactic year?

58. Given: Schwarzschild radius, $r = \frac{2GM}{c^2}$ where G is the gravitational constant, M is the mass of the black hole, c is the speed of light, and r is the radius of the black hole. Calculate the volume in liters of a perfect sphere of water so that there is just enough water to form a black hole. Assume that the density stays constant.

59. A dumb hole (or a sonic black hole) is a type of black hole where phonons rather than photons are unable to escape. After expanding/compressing the universe's radius to create a dumb hole, what is the radius of the new universe (in meters)? Take into account baryonic matter, dark matter, and dark energy. Assume the dumb hole to be surrounded by dry air at 20 degrees Celcius.

60. Pick an integer from 1 to 300 inclusive. The answer will be the product of the answers to this question from all teams that answer this question.