

Fermi Questions: F-M Invitational-ANSWER KEY

[1] How many golf balls could fit in this room, assuming normal stacking?

FA___7

www.leaderboard.com/glossary_balldiameter

https://en.wikipedia.org/wiki/Sphere_packing

[2] What is the weight, in micro-Newtons, of the people taking this test in this room right now?

FA___7

[3] How tall (in mm) would be a stack of paper with 1 billion stars this size * on this style paper (with these margins) be?

(Note that for the exam I used 11 pt Arial font and 1" margins. The font and margins on this key were changed to fit the exam on a single sheet of paper) .

www.sciencealert.com/a-piece-of-paper-folded-103-times-will-be-as-thick-as-the-universe

FA___4

[4] If it became your day job to count money in \$1s, how many work days would it take you to count the total value of the money contained in Fort Knox?

<https://www.quora.com/How-much-gold-is-in-Fort-Knox-and-is-it-enough-to-get-the-U...>

FA___7

[5] Consider a regular dodecahedron. Let A=Number faces, B=Number of edges, C=the number of Platonic Solids, D=the number of vertices, and E=sum of all interior angles of a regular dodecahedron. Compute $AxBxDxE$

https://en.wikipedia.org/wiki/Regular_dodecahedron

FA___6

[6] What is the Average Kinetic Energy of the average hornet in kilowatt-hours?

<http://www.bumblebee.org/invertebrates/HymenopteraHornets.htm>

FA___(-14)

[7] How many pints of honey were produced in 2014 in the USA?

<https://www.dadant.com/news/2014-united-states-honey-production-up-19-percent>

<https://www.reference.com/food/much-honey-weigh-92d175eae9fea95a>

FA___8

[8] How many times does a worker honey bee flap its wings during it's life?

<http://centralma.thebeehunter.com/things-to-know-about-bees.html>

www.bbka.org/learn/general_information/life_in_the_hive

FA___8

[9] How many years would it take Chipotle to sell 1 mole of their burritos?

<https://www.bloomberg.com/news/articles/2016-02-02/chipotle-s-sales-have-dropped-by-10-3-million-burritos>

FA___15

[10] How many Joules of energy will be consumed today by Science Olympians here at the F-M Invitational as a result of Chipotle consumption?

www.nytimes.com/interactive/2015/02/.../what-do-people-actually-order-at-chipotle.htm...

FA___9

[11] At the inferior burrito establishment Moe's, you are always given a serving of tortilla chips with your burrito. How many ears of corn are needed to produce all the tortilla chips that Moe's serves in a year?

<http://www.serious-eats.com/2016/04/how-to-make-fresh-nixtamalized-corn-tortillas-from-scratch.html>

<http://www.moes.com/food/nutrition/add-ons-extras/>

FA___10

[12] Strictly from calories, how many M&Ms would a person have to eat per year to survive?

www.myfitnesspal.com/food/calories/m-ms-one-plain-m-m-54161636

FA___5

[13] On average, how many molecules of H₂O should a healthy person consume each second of the day?

<http://www.thenakedscientists.com/forum/index.php?topic=12443.0>

FA___21

[14] The Red Giant Betelgeuse is one of the largest and most luminous visible to us while stargazing at night. If you were looking up at Betelgeuse right now, how many seconds ago were the photons of light you're seeing produced in Betelgeuse?

<https://en.wikipedia.org/wiki/Betelgeuse>, $c=3 \times 10^8$, $d=v/t$

FA_____10

[15] Protons and antiprotons can completely annihilate each other, and produce energy in the form of gamma rays. If this energy could be all converted into electricity, at what rate would the particles need to be annihilated to light a 100 watt light-bulb? (i.e. calculate the number of annihilations per second)

$M=1.67 \times 10^{-27}$ kg, use $E=mc^2$

FA_____11

[16] If two large males each possessed 1% more electrons in their body and were separated by a distance of 1m, how many g's of acceleration would each person initially experience?

Use Coulomb's law.

FA_____22

[17] By what factor is the electrostatic force of repulsion between the two males above larger than the gravitational force of attraction between them?

Use Newton's Law of Universal Gravitation

FA_____31

[18] By what factor is the deBroglie wavelength of a small adult female walking at a normal pace larger than the planck length?

DeBroglie Wave-Particle Duality Equation

FA_____0

[19] How many photons of light are emitted from an average human during a typical day?

Humans emit light in the infrared spectrum as a result of being ~98.1F-blackbody radiation, use Planck's equation, $E=hf$

FA_____26

[20] How many parsecs a spacecraft leaving the earth at escape velocity travel in a googol seconds worth of time?

$V_{\text{escape}}=11.186$ km/s, 1parsec= 3.086×10^{13} m, 1 googol= 1×10^{100}

FA_____87

[21] How many times could all of your DNA in your body wrap around the equator of the Earth if it were connected and stretched in a straight line?

hypertextbook.com/facts/1998/StevenChen.shtml

www.smithsonianmag.com/smart.../there-are-372-trillion-cells-in-your-body-4941473/

FA_____3

[22] How many frames of film were needed to create the entire Main Saga Films in the current *Star Wars* movie franchise? (i.e. episodes 1-7)

motherboard.vice.com/read/now-you-can-watch-all-six-star-wars-films-at-the-same-time

FA_____6

[23] Let Jan 1st =1, Jan 2nd=2, ..., and December 31st=365. Determine the number of cheerios eaten by all americans in 2015 on days which are prime numbers.

<https://www.reference.com/math/many-bowls-cereal-average-american-eat-annually-b6383df080f94cf2>

FA_____12

[24] If the entire Earth were 100% covered in Solar Panels, how much energy would be produced in 1 year in kilowatt-hours?

www.grg.northwestern.edu/projects/vss/.../power/2-how-efficient-are-solar-panels.html

<http://www.sandia.gov/~jytsao/Solar%20FAQs.pdf>

FA_____18

[25] How many hours would we need these solar panels to be on for in order to provide the energy used by the entire Earth's population for an entire year?

https://en.wikipedia.org/wiki/World_energy_consumption

FA_____0