

It's the Little Things that Count

2. If all the water on earth was gathered together to make one huge, spherical drop that is $\frac{1}{3}$ of the diameter of the moon, how many little, tiny water molecules are on the earth?

Given:

Estimate: # H₂O molecules / 1 earth

- There are about 6×10^{23} molecules in 1 mole.
- One third of the moon's diameter equals the huge drop's diameter. (Volume is $\frac{4}{3} \pi r^3$.)
- The diameter of the moon is about 2,000 miles.
- There are 1.6 km in a mile. (Remember that volume is cubic.)
- There are 100 cm in a meter. (Remember that volume is cubic.)
- There are 1,000 meters in a km. (Remember that volume is cubic.)
- There is 1 ml of water in 1 g of water.
- There are 18 g of water per mole.
- 1 ml is 1 a cubic cm.
- There is only 1 huge drop per earth.

2. Estimate the number of grains of dirt the earth would be made of if it were made of dirt all of the way to its core (which is actually molten iron).

Given:

Estimate: # grains / 1 earth

- Grain diameter = 0.1 mm (Volume is $\frac{4}{3} \pi r^3$.)
- Earth diameter = 8,000 miles (Volume is $\frac{4}{3} \pi r^3$.)
- 1,000 mm = 1 m (Remember that volume is cubic.)
- 1,000 m = 1 km (Remember that volume is cubic.)
- 1.6 km = 1 mile (Remember that volume is cubic.)

3. Your food calories could turn into electrical power in watts. Estimate how many watts you would use if you eat 2,000 calories today.

Given:

Estimate: # watts

- You eat 2,000 cal / 1 day
- 1 watt = 1 joule / 1 second
- 4,184 joules = 1 cal
- 1 day = 24 hr
- 60 min = 1 hr
- 1 min = 60 sec

Larger Things

*** Super-Duper-Extra-Hard ***

Almost all of the water on earth and in our air stays here. Gravity keeps it from flying off into space. Therefore, the water you drink is the same water that was on our planet for Helen Keller, Jesus, Aristotle, or Buddha to drink. Did you ever wonder how many water molecules in the next glass of water you drink could have been shared with one of your heroes?

Given: Estimate: # H₂O molecules per 1 life / 1 glass per earth

- An average life is about 70 yrs.
- A person drinks about 6 glasses / 1 day.
- 1 glass is about 8 ounces.
- 1 ounce is about 30 ml.
- 1 ml water weighs 1 g.
- 1 mole of water weighs about 18 g.
- There are about 6×10^{23} molecules in 1 mole.
- There is about 1 billion km³ of water on earth (that's a cubic volume).
- 1 yr is about 365 days.
- 1 cm³ = 1 ml.
- 100 cm = 1 m.
- 1,000 m = 1 km.

Let's solve this in 3 separate steps: A, B, C. The final equation is: $A \times C$, or B

$$\begin{array}{l}
 A \dots (\text{H}_2\text{O molecules} / 1 \text{ life}) \\
 \text{-----} \times C \dots (\text{H}_2\text{O molecules} / 1 \text{ glass}) \\
 B \dots (\text{H}_2\text{O molecules} / 1 \text{ earth})
 \end{array}$$