

Miscellaneous conversion problems:

1. A dollar bill is about 0.1 mm thick. How many dollar bills would make a stack that reaches to the moon (approx. a quarter of a million miles)? Compare the estimated cost of the Iraq war.
2. Light travels at about 3×10^8 meters per second. How long does it take in minutes for light from the sun to reach earth, 93 million miles away?
3. If Comcast's internet service can send data at a rate of 5 Mbps (Mega (million) bits per second), how many 0.75-megabyte photos of your kitty can you upload in a day? (Note: 1 byte = 8 bits)
4. If 2 inches of rain fell on the entire Willamette Valley in a day, how much rain is that in gallons? Hint: "an inch of rain" means enough rain to cover the region with water 1 inch deep. Look up the area of the Willamette Valley, or for a bonus, do the entire thing as a Fermi problem, making reasonable estimates.
5. Fermi problem: Estimate the volume of Ford Hall in liters. (assume the interior walls and contents are removed to make more room for water.)
6. FEMA tells us that we should store 3 gallons per day per person of emergency water in our dwelling, with the assumption that we want a three-day supply. Disaster relief professionals suggest that a three-week supply is more appropriate. In a household with four people, what is the volume of water, in cubic feet, that they would need to meet the three-week criterion? If we made a cubical tank to hold this much water, how long would it be on each side?
7. A box of 100 DVDs has a volume of about 2000 cm^3 . If we made a DVD movie of every human being on earth (7 billion of them), how many cubic meters of volume would our DVD storage cabinet need?
8. An ordinary DVD hold 4.7 Gigabytes (billion bytes) of data. Using the previous problem, how many 0.75-megabyte photos of our kitty can we store per cubic foot of DVDs?
9. The City of Salem has the rights to use 227 cubic feet per second of water from the Santiam River (this is the city's main source of water). How long would it take in years to fill Crater Lake at this rate, given that Crater Lake contains 15 million acre-feet of water (and acre-foot is the amount of water that would cover one acre of land with water one foot deep.)
10. The Santiam river flows out of Detroit Lake about 60 miles east of Salem. Detroit Lake holds 455 thousand acre-feet of water. The flow rate of the Santiam River at Lyons is 15.8 thousand cubic feet per second when the river is full. How long would it take, in days, to drain the entire Detroit Lake at this rate?