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# Dimensional Analysis Problems

1. The distance from the thumb to the little finger on Coach Oates' hand is 9.0 inches. Convert this to centimeters.
2. According to the Guinness Book of Records the heaviest baby ever born weighed 29 lbs 4 oz. (29.25 lbs). What was the baby's mass in kg? (Historical Note: The birth occurred in Effingham IL in 1939 and due to respiratory problems the baby died two hours later. The heaviest babies to survive weighed 22.5 lbs and were born in 1955 and 1982.)
3. Your cross country skis are 210 cm long. What is their length in inches?
4. A condor has a wing span of 3.05 m. What is the wing span in feet?
5. In Europe gasoline is sold by the liter. Assume that it takes 14 gallons of gasoline to fill the tank of a compact car. How many liters of gasoline will it take?
6. You have just received a French cookbook from the exchange student. You want to make 3.0 quarts of punch for a party. Will a recipe of 2.5 L be enough?
7. Some owls maintain territories of up to 3 acres. How many owls could live in a large wooded area of 20 hectares? (1 hectare=1 sq. dekameter=100 m<sup>2</sup>= 2.47 acres)
8. Ruth Palladium (RuPd) bought 10. acres of land and built a house on 2.0 acres. RuPd wanted to raise sheep on the remaining 8.0 acres. If it takes 1/8 (0.125) hectare to raise one sheep, how many sheep can be raised on the 8 acres.
9. One 1.6 oz. of package of cinnamon and spice instant oatmeal contains 34 g of carbohydrates. If you had instant oatmeal 6.0 days a week, how many ounces of carbohydrate would you consume in a week? (16 oz =1 lb = 454 G =256 Drams = 7000 Grains)
10. Many candybars have 9 g of fat per bar. If during a "chocolate attack" you ate one pack of candy (0.6 dekabars), how many ounces of fat would you have eaten? There are approximately 9 Calories per gram of fat, how many Calories is this?
11. If the RDA for vitamin C is 60. mg per day and there are 70. mg of vitamin C per 100. g of orange, how many 3.0 oz. oranges would you have to eat each week to meet this requirement?
12. If Gasp cigarettes have 5 mg tar and 0.4 mg nicotine per cigarette and there are 20. cigarettes per pack, how many packs of cigarettes would have to be smoked to coat your lungs with 4.0 oz (1/4 lb.) of tar? How many packs would you have to smoke to introduce your lungs to one gram of drug nicotine?
14. Recently, Dr. Louis Frank has suggested that Earth may be pelted by thousands of house-sized comets. Satellite imagery has been inconclusive, and the idea remains controversial. When Frank first considered the idea of mini-comets falling to Earth, he no doubt scrambled to make a quick Dimensional Analysis calculation. Comets can be thought of as dirty snowballs - maybe Earth's

oceans have accumulated from these comets over the ages! Use the following information to estimate what percent of Earth's oceans could be accounted for given a constant bombardment by comets over the last 4 billion years (the estimated age of the earth). You will need the following information:

Each mini-comet contains about 30. tons of water

- 1 ton = 2000 pounds
- 1 pound = 454 grams
- density of water is  $1 \text{ g/cm}^3$
- 15 000 mini-comets hit the Earth each day
- Earth's oceans occupy 1.36 billion  $\text{km}^3$

Note: Many people don't accept Dr. Frank's mini-comet theory, but, if he's right, it would radically change our understanding of Earth science. You don't need to worry about getting hit by these comets, they are vaporized long before they reach the surface.

15. Mark McGuire hit 70 home runs in the 1998 season. Given that there are 4 bases with 90. feet between each base, how many miles did he run last season just from home runs?

16. Your chemistry teacher empties his dehumidifier tank once a day. If the capacity of the tank is 2 gallons, determine how many molecules of water did the dehumidifier collect from the air per millisecond.

- 1 quart = 0.94633 liter
- 4 quarts = 1 gallon
- density of water is  $1 \text{ g/mL}$
- $18 \text{ g water} = 6.02 \times 10^{23}$  molecules of water

17. In one of the episodes of the TV program *McGyver*, a plane load of gold was being transported from the Soviet Union to the United States during World War II. The plane crashed in the Arctic region and to prevent the "bad guys" from getting the gold the pilot and co-pilot transferred it to a cave by stacking the gold on a door of the crashed plane and pulling the gold on this "sled" to the cave. You were led to believe in the episode that they accomplished the move in one trip because the gold was neatly stacked on the "sled" in the cave. The neatly stacked gold measured about 1 meter on a side. Calculate the weight, in tons, of one cubic meter of gold and determine if it would be possible for the two pilots to accomplish this feat. Would a plane of WWII vintage be able to carry this amount of gold? ( $\rho_{\text{Au}} = 19.4 \text{ g/cm}^3$ )

18. Look up the current price of gold. What would one cubic meter of gold be worth today? You may assume that 1 troy ounce of gold equals 31.1 g. [ Note: one Advp. ounce is equal to about 28.3 grams. Different conversion factors are used for gold and silver because there are two different English ounces. One pound of gold is about 373 grams, while one pound of sand, or just about everything else, is about 454 grams.]

19. At one time Rigel IV, a class M planet. had a system of weights and measures called the Bozo system. This system was created and used by the Bozonians, who lived on a continent in the

Northern hemisphere, and had all of the deficiencies of the current English system on earth. The relationships between the various units used for length in the Bozo system are given below:

- 325 cubebs = 1 furbish
- 6 furbishes = 1 nautical smile
- 20 nautical smile = 1 minor league
- 3 minor leagues = 1 major league

Using the above conversion factors determine the number of furbishes a Bozonian would have to walk if his doctor recommended that he walk 2.0 major leagues each day to maintain cardiovascular health.

20. Jason Biehl raised 60 goats, then entered into a series of business transactions. He traded all the goats for sheep at an exchange rate of 5 goats for 7 sheep. Next, he exchanged all the sheep for hogs at a rate of 4 sheep for 2 hogs weighing 250 lbs. each. He sold all the hogs at a market price of \$55.00 per 100.0 lbs. How much money did he make from the 60 goats?

21. How much would it cost Craig Marcus in dollars to buy nails used to build a fence 125 meters long if it requires 30 nails per meter? Assume that 40 nails are sold per box at a cost of \$.75 per box.

22. Eggs are shipped from a poultry farm in trucks. The eggs are packed in cartons of one dozen eggs each; cartons are placed in crates that hold 20 cartons each. The crates are stacked in the trucks, 5 crates across, 25 crates deep and 25 crates high. How many eggs are in 5 truckloads?

23. How many miles could you drive for \$7.90 if the gas mileage of your car is 14 km/liter of gas and the price is \$1.29/gal? (1.61 km/mile, 4 qt/gal, 1.1 qt/L)

24. David Hill operates a crane that can pick up 3.0 tons of excavated earth in an hour. Dave's wages are \$35 per hour. What, then, is the cost of picking up 85 kg of excavated earth? (2.2 lb/kg, 2000 lb/ton)

25. If one afternoon Mike Gauthier decides to dig a hole through the earth to China for a game of ping pong, how many centuries would elapse before he got there if he dug at a rate of 0.400 miles depth per day and the diameter of the earth is  $1.2700 \times 10^7$  m? (1.61 km/mile)