DIMENSIONAL ANALYSIS PROBLEMS

Conversions Factors			
1 hr = 60 min	1 min = 60 sec	1 ton = 2000 lbs	7 days = 1 week
24 hrs = 1 day	1 kg = 2.2 lbs	1 gal = 3.79 L	264.2 gal = 1 cubic meter
1 mi = 5,280 ft	1 kg = 1000 g	1 lb = 16 oz	20 drops = 1 mL
365 days = 1 yr	52 weeks = 1 yr	2.54 cm = 1 in	1 L = 1000 mL
0.621 mi = 1.00 km	1 yd = 36 inches	1 cc is 1 cm^3	1 mL = 1 cm^3

DIRECTIONS: Solve each problem using dimensional analysis. Every number must have a unit. Work must be shown. Conversion factors are given below

1.) How many miles will a person run during a 10 kilometer race?

2.) The moon is 250,000 miles away. How many feet is it from earth?

3.) A family pool holds 10,000 gallons of water. How many cubic meters is this?

4.) The average American student is in class 330 minutes/day. How many hours/day is this?

How many seconds is this?

5) How many seconds are there in 1 year?

6) Lake Michigan holds 1.3 x 10^{15} gallons of water. How many liters is this?

7) Pepsi puts 355 ml of pop in a can. How many drops is this?

How many cubic meters is this?

8) Chicago uses 1.2×10^9 gallons of water /day. How many gallons per second must be pumped from the lake every second to supply the city?

9) Sixty miles/ hour is how many ft/sec?

10) Lake Michigan holds 1.3×10^{15} gallons of water. If just Chicago removed water from the lake and it never rained again, how many days would the water last? Chicago uses 1.2×10^9 gallons of water /day

11). How many minutes are in 180.0 days?

12). If a person weighs 125 lbs, 8 oz., how many mg does s/he weigh?

13). The distance from Santa Maria to Los Alamos is 16.25 mi. What is the distance in cm?

14). Santa Maria has an elevation of 6.30×10^5 mm. How many km is this elevation?

15). If a projectile travels 3.00×10^3 feet in one second, how far will it travel in 18 minutes?

16). A small herd of cattle consumes fourteen bales of hay in two weeks. How many bales will this herd consume in a year?

17). During the previous year, Zach's weather station measured 0.8 yards of rain. Express this amount in cm.

18). If a swimmer swims 85.4 yards in five minutes, how many meters will s/he swim in 70.0 seconds?

19). Saffron costs $368.00 per ounce. Determine how many grams you can purchase for $15.00.

20). How many grams are equivalent to 1.80×10^{-4} tons? (English tons)

21). A gas station is charging $1.299 per gallon of gas. What would be the price for a liter of gas?

22). Determine the number of years in 8.35×10^6 minutes.

23). A quart of a liquid has a mass of 2.70 kilograms. How many quarts will take to weigh 100.0 pounds?

24). Sixty-two months is equivalent to how many seconds?

25). A car consumes 25.00 gallons of fuel when driving a distance of 400.0 km. How many gallons will it consume when driving 250.0 miles?

26). 0.0054 weeks is equivalent to how many minutes?

27). How many feet per second is a wave going if it travels a distance of one mile in 7.35 seconds?

Dimensional Analysis Word Problems

You must use the formal method of dimensional analysis as taught in this class in order to get credit for these solutions (one point for each correct solution). Later in the course you may use any method of dimensional analysis to solve this type of problem.

1. Every three times I clean my bedroom, my mother makes me an apple pie. I cleaned my bedroom 9 times. How many apple pies does she owe me? (What? Your mother doesn't reward you for cleaning your bedroom? Aren't there child labor laws? To make up for that injustice, you may have this very easy extra credit problem.)

2. A chemistry teacher working at a golf camp during the summer found a liquid, which caused him to slice ball after ball into the water without disturbing him at all. He thought that this was an important liquid to identify so he set out to determine its density. He found that a sample of the liquid had a mass equal to 455 golf balls and occupied a volume of 620 water cups that he obtained at the 7th hole. Each golf ball massed 50 g and the water cups at the 7th hole of the golf course held 45 mL each. What is the density of the unknown liquid?

3. A Wilton High School senior was applying to college and wondered how many applications she needed to send. Her counselor explained that with the excellent grade she received in chemistry she would probably be accepted to one school out of every three to which she applied. [*3 applications = 1 acceptance*] She immediately realized that for each application she would have to write 3 essays, [*1 application = 3 essays*] and each essay would require 2 hours work *[1 essay = 2 hours]*. Of course writing essays is no simple matter. For each hour of serious essay writing, she would need to expend 500 calories [*1 hour = 500 calories*] which she could derive from her mother's apple pies [1 pie = 1000 calories]. How many times would she have to clean her room in order to gain acceptance to 10 colleges? Hopefully you didn't skip problem No 1. I'll help you get started.... 10 acceptances [ ] [ ] etc.

4. How much force, in g cm / s² , is exerted by a golf ball described in problem 2 striking a tree while accelerating at 20 cm / s² ? Show how you can solve this problem without knowing that F = m a. Explain your solution.

5. Because you never learned dimensional analysis, you have been working at a fast food restaurant for the past 35 years wrapping hamburgers. Each hour you wrap 184 hamburgers. you work 8 hours per day. you work 5 days a week. you get paid every 2 weeks with a salary of $840.34. How many hamburgers will you have to wrap to make your first one million dollars? [You are in a closed loop again. If you can solve the problem, you will have learned dimensional analysis and you can get a better job. But, since you won't be working there any longer, your solution will be wrong. If you can't solve the problem, you can continue working which means the problem is solvable, but you can't solve it. We have decided to overlook this impasse and allow you to solve the problem as if you had continued to wrap hamburgers.]