Slashes are the Devil

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.)

$$9\ \text{cleanings} \times \frac{1\ \text{pie}}{3\ \text{cleanings}} = \boxed{3\ \text{pies}}$$

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?

$$\frac{455\ gb}{620\ wc} \quad \frac{1\ gb}{50\ g} \quad \frac{1\ wc}{45\ mL} \Bigg\} \text{density} = \frac{g}{mL}$$

$$\frac{50\ g}{1\ gb} \times \frac{455\ gb}{620\ wc} \times \frac{1\ wc}{45\ mL} = \boxed{0.82\ \frac{g}{1\ mL}}$$

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.

$$10\ \text{acc} \times \frac{3\ \text{apps}}{1\ \text{acc}} \times \frac{3\ \text{ess}}{1\ \text{app}} \times \frac{2\ \text{h}}{1\ \text{ess}} \times \frac{500\ \text{cal}}{1\ \text{h}} \times \frac{1\ \text{pie}}{1000\ \text{cal}} \times \frac{3\ \text{clean}}{1\ \text{pie}} =$$

$$\boxed{270\ \text{cleanings}}$$

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

$$\frac{50\,g}{1\,gb} \times \frac{20\,cm}{s^2} = \frac{1000\,g\,\frac{cm}{s^2}}{1\,gb}$$

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.]

$$\$1\,000\,000 \times \frac{2wk}{\$840.34} \times \frac{5d}{wk} \times \frac{8h}{d} \times \frac{184\ hamburgers}{1h} =$$

17 516 719 Hamburgers

1.75×10^7 Hamburgers