Dimensional Analysis Practice Problems

Notes

1. Units and SI prefixes

a. Pico-	p	0.000000000001	10^{-12}
b. Nano-	n	0.000000001	10^{-9}
c. Micro-	μ	0.000001	10^{-6}
d. Milli-	m	0.001	10^{-3}
e. Centi-	c	0.01	10^{-2}
f. Deci-	d	0.1	10^{-1}
g. N/A		1	10^{0}
h. Hecto-	h	100	10^{2}
i. Kilo-	k	1,000	10^{3}
j. Mega-	M	1,000,000	10^{6}
k. Giga-	G	1,000,000,000	10^{9}
l. Tera-	T	1,000,000,000,000	10^{12}

2. Significant Figure Rules
   a. Addition/Subtraction – Lowest number of decimal places
   b. Division/Multiplication – Lowest number of significant figures

Practice Problems

1) When one gram of gasoline burns in a car's engine, the amount of energy given off is approximately 1.03×10^4 cal. Express this quantity in joules (J). (Use 1 cal = 4.184 J)

2) The pressure reading from a barometer is 742 mm Hg. Express this reading in kilopascals, kPa. (Use 760 mm Hg = 1.013×10^5 Pa)

3) How many megayears is equivalent to 6.02×10^{23} nanoseconds (ns)?

4) Because your 18 year-old friend never learned dimensional analysis, he started working at a fast food restaurant wrapping hamburgers. Every 3 hours he wraps 350 hamburgers. He works 8 hours per day. He works 5 days a week. He gets paid every 2 weeks with a salary of $440.34.

   a. Approximately how many hamburgers will he have to wrap to make his first one million dollars? (Approximate to the nearest burger)

b. How many years will it take to wrap all those hamburgers? Express the time in years. Assume that he will work 40 weeks out of the year and that heworks with the same efficiency everyday.

5) A patient in the hospital is given an intravenous fluid that must deliver 1000 cc (1 cc = 1 mL) of a dextrose (sugar) solution over 8 hours. The intravenous fluid tubing delivers 15 drops/cc. What is the drop rate (in units of drops/min) that must be administered to the patient?

6) All matter has a property called a specific heat capacity. For silver, this specific heat capacity is 0.24 J/°C · g. How much energy (in Joules) would be required to heat 120.0 g of silver (Ag) so that its temperature changes by 32°C?

7) Finally, to round off yesterday's call here is a more challenging question.

The balanced reaction of sulfuric acid with sodium hydroxide is shown below:

$$H_2SO_4 + 2\ NaOH\ Na_2SO_4 + 2\ H_2O$$

For 146 grams of H_2SO_4, how many grams of H_2O can be made (assume you have all the NaOH you need for a complete reaction)?

Answers: 4.31×10^4 J, 98.9 kPa, 19.1 megayears, 2×10^7 burgers, 114 years, 31 drops/minute, 920 J, 53.7 g H_2O