Dimensional Analysis Worksheet

Set up and solve the following using dimensional analysis.

1 mile = 5,280 ft
1 inch = 2.54 cm
3 feet = 1 yard
454 g = 1lb
946 mL = 1 qt
4 qt = 1 gal

Don't forget: <u>What you want</u>
<u>What you've got</u>

1) 5,400 inches to miles   1

$$\frac{5400 \text{ in}}{} \left| \frac{1 \text{ ft}}{12 \text{ in}} \right| \frac{1 \text{ mi}}{5280 \text{ ft}} = 0.085 \text{ miles}$$

2) 16 weeks to seconds

$$\frac{16 \text{ weeks}}{} \left| \frac{7 \text{ days}}{1 \text{ week}} \right| \frac{24 \text{ hour}}{1 \text{ day}} \left| \frac{60 \text{ min}}{1 \text{ hr}} \right| \frac{60 \text{ S.}}{1 \text{ min}} = 9,676,800 \text{ s}$$

3) 54 yards to mm

$$\frac{54 \text{ yards}}{} \left| \frac{3 \text{ ft}}{1 \text{ yd}} \right| \frac{12 \text{ in}}{1 \text{ ft}} \left| \frac{2.54 \text{ cm}}{1 \text{ in}} \right| \frac{10 \text{ mm}}{1 \text{ cm}} = 49,377.6 \text{ mm}$$

4) 36 cm/sec to mph

$$\frac{36 \text{ cm}}{\text{sec}} \left| \frac{1 \text{ in}}{2.54 \text{ cm}} \right| \frac{1 \text{ ft}}{12 \text{ in}} \left| \frac{1 \text{ mi}}{5280 \text{ ft}} \right| \frac{60 \text{ sec}}{1 \text{ min}} \left| \frac{60 \text{ min}}{1 \text{ hr}} \right| = 0.805 \text{ mph}$$

5) 1.09 g/mL to lbs/gal

$$\frac{1.09 \text{ g}}{\text{mL}} \left| \frac{1b}{454g} \right| \frac{946 \text{ mL}}{qt} \left| \frac{4qt}{1 gal} \right. = 9.08 \text{ lbs/gal}$$

6) 19 inches to feet

$$\frac{19 \text{ in}}{} \left| \frac{ft}{12 \text{ in}} \right. = 1.58 \text{ ft}$$

7) 840 inches to cm

$$\frac{840 \text{ in}}{} \left| \frac{2.54 \text{ cm}}{1 \text{ in}} \right. = \cancel{70 \text{ cm}} \ 2,133.6 \text{ cm}$$

8) 4.22 g/cm to lbs./ft

$$\frac{4.22 \text{ g}}{\text{cm}} \left| \frac{1b}{454g} \right| \frac{2.54 \text{ cm}}{1 \text{ in}} \left| \frac{12 \text{ in}}{ft} \right. = 0.28 \text{ lbs/ft}$$

9) 32 ft/sec to meters/min

$$\frac{32 \text{ ft}}{\text{sec}} \left| \frac{12 \text{ in}}{1 ft} \right| \frac{2.54 \text{ cm}}{1 \text{ in}} \left| \frac{1 m}{100 \text{ cm}} \right| \frac{60 s}{1 \text{ min}} = 585.2 \text{ m/min}$$

10) Write, and then solve your own dimensional analysis problem. Be creative!

11) You have the Heebie-Geebies. Your grandmother sends you a remedy for the Heebie-Geebies with the following instructions: "Take 1 drop per 10 lbs. of body weight per day divided into 4 doses until the Heebie-Geebies are gone." How many drops do you take per dose??

$$\frac{150 \text{ lbs}}{\text{day}} \mid \frac{1 \text{ drop}}{10 \text{ lbs}} \mid \frac{1 \text{ day}}{4 \text{ doses}} = 3.75 \text{ drops/dose}$$

12) You're throwing a pizza party for 15 people and figure that each person will eat 4 slices. You call up the pizza place and larn that each pizza will cost you $14.78 and it will be cut into 12 slices. How much is the pizza going to cost you? You only have $70. Will you have enough money?

$$\frac{15 \text{ people}}{} \mid \frac{4 \text{ slices}}{\text{person}} \mid \frac{\text{pizza}}{12 \text{ slices}} \mid \frac{\$14.78}{\text{pizza}} = \$73.90$$

no. you are $3.90 short.

13) 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 problem.)

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

14) In my chemistry class, 28 students are each given 3 pens. If there are 8 pens in one package, priced at $1.88 per package, what is the total cost of giving away pens?

$$\frac{28 \text{ students}}{} \mid \frac{3 \text{ pens}}{\text{student}} \mid \frac{\text{package}}{8 \text{ pens}} \mid \frac{\$1.88}{\text{package}} = \$19.74$$

15) Convert 5.70 Kilograms to milligrams. Show your work!

$$\frac{5.70 \text{ kg}}{} \left| \frac{1000 \text{ g}}{1 \text{ kg}} \right| \frac{1000 \text{ mg}}{1 \text{ g}} = 5,700,000 \text{ mg}$$

16) You find 13,406,190 pennies. How many dollars did you actually find? If each penny weighs 4 grams, how much did all that loot weigh in lbs.?
(2.2 lbs = 1 Kilogram

$$\frac{13,406,190 \text{ pennies}}{} \left| \frac{1 \text{ dollar}}{100 \text{ pennies}} \right. = \$ 134,061.90$$

$$\frac{13,406,190 \text{ pennies}}{} \left| \frac{4 \text{ g}}{1 \text{ penny}} \right| \frac{1 \text{ kg}}{1000 \text{ g}} \left| \frac{2.2 \text{ lb}}{1 \text{ kg}} \right. = 117,974.47 \text{ lb}$$

17) Assume a movie ticket costs $9, how many movie tickets could you buy with the pennies you found in #8?

$$\frac{\$134,061.90}{} \left| \frac{\text{ticket}}{\$ 9} \right. = \cancel{\$} \ 14,895 \text{ tickets}$$

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?

$$\frac{10 \text{ km}}{} \left| \frac{0.621 \text{ mi}}{1 \text{ km}} \right. = 6.21 \text{ mi}$$

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

$$\frac{250,000 \text{ mi}}{} \left| \frac{5280 \text{ ft}}{1 \text{ mi}} \right. = 1,320,000,000 \text{ ft}$$

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

$$\frac{10,000 \text{ gal}}{} \left| \frac{1 \text{ m}^3}{264.2 \text{ gal}} \right. = 37.85 \text{ m}^3$$

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

$$\frac{330 \text{ min}}{\text{day}} \left| \frac{1 \text{ hr}}{60 \text{ min}} \right. = 5.5 \text{ hr/day}$$

How many seconds is this?

$$\frac{330 \text{ min}}{\text{day}} \left| \frac{60 \text{ s}}{1 \text{ min}} \right. = 19,800 \text{ s}$$

5) How many seconds are there in 1 year?

$$\frac{1 \text{ yr}}{} \left| \frac{365 \text{ days}}{1 \text{ yr}} \right| \frac{24 \text{ hr}}{1 \text{ day}} \left| \frac{60 \text{ min}}{1 \text{ hr}} \right| \frac{60 \text{ s}}{1 \text{ min}} = 31,536,000 \text{ s}$$

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

$$\frac{1.3 \times 10^{15} \text{ gal}}{} \left| \frac{3.79 \text{ L}}{1 \text{ gal}} \right. = 4.9 \times 10^{15} \text{ L}$$

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

$$\frac{355\ mL}{can} \left| \frac{20\ drops}{1\ mL} \right. = 7,100\ drops$$

$$100\ cm = 1\ m$$
$$100^3\ cm^3 = 1^3\ m^3$$
$$1,000,000\ cm^3 = 1\ m^3$$

How many cubic meters is this?

$$\frac{355\ mL}{can} \left| \frac{1\ cm^3}{1\ mL} \right| \frac{1\ m^3}{1,000,000\ cm^3} = 3.55 \times 10^{-4}\ m^3$$
$$0.000355\ m^3$$

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?

$$\frac{1.2 \times 10^9\ gal}{day} \left| \frac{1\ day}{24\ hr} \right| \frac{1\ hr}{60\ min} \left| \frac{1\ min}{60\ sec} \right. = 13,888.8\ gal/s$$

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

$$\frac{60\ mi}{hr} \left| \frac{5280\ ft}{1\ mi} \right| \frac{1\ hr}{60\ min} \left| \frac{1\ min}{60\ s} \right. = 88\ ft/sec$$

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

$$\frac{1.3 \times 10^{15}\ gal}{} \left| \frac{day}{1.2 \times 10^9\ gal} \right. = 1,083,333.3\ days$$

11). How many minutes are in 180.0 days?

$$\frac{180\ days}{} \left| \frac{24\ hr}{1\ day} \right| \frac{60\ min}{1\ hr} = 259,200\ min$$

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

$$\frac{8\ oz}{} \left| \frac{1\ lb}{16\ oz} \right. = 0.5\ lb + 125\ lb$$

$$\frac{125.5\ lb}{} \left| \frac{454\ g}{1\ lb} \right| \frac{1000\ mg}{1\ g} = 56,977,000\ mg$$