or Factor Label method

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?

$$10\ km \times \frac{0.621\ mi}{1.00\ km} = 6.21\ km$$

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

$$2.5 \times 10^5\ mi \times \frac{5280\ ft}{1\ mi} = 1.32 \times 10^9\ ft$$

yes use scientific notation

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

$$1 \times 10^5\ gal \times \frac{1\ m^3}{264.2\ gal} = 38.9\ m^3$$

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

$$\frac{330\ min}{1\ d} \times \frac{1\ h}{60\ min} = \frac{5.5\ h}{1\ d}$$

How many seconds is this?

$$5.5\ h \times \frac{60\ min}{1\ h} \times \frac{60\ s}{1\ min} = 1.98 \times 10^4\ s$$

5) How many seconds are there in 1 year?

$$1\ yr \times \frac{365\ d}{1\ yr} \times \frac{24\ h}{1\ d} \times \frac{60\ min}{1\ h} \times \frac{60\ s}{1\ min} = 3.16 \times 10^7\ s$$

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

$$1.3 \times 10^{15}\ gal \times \frac{3.79\ L}{1\ gal} = 4.927 \times 10^{15}\ L$$

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

$$355\,mL \times \frac{20\,d}{1\,mL} = 7100\ drops$$

How many cubic meters is this?

$$355\,mL \times \frac{1\,cm^3}{1\,mL} \times \frac{1\,m}{100\,cm} \times \frac{1\,m}{100\,cm} \times \frac{1\,m}{100\,cm} = 3.55 \times 10^{-6}\,m^3$$

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?

$$\frac{1.2 \times 10^9\,gal}{1\,d} \times \frac{1\,d}{24\,h} \times \frac{1\,h}{60\,min} \times \frac{1\,min}{60\,s} = 1.39 \times 10^4\,\frac{gal}{s}$$

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

$$\frac{60\,mi}{1\,h} \times \frac{5280\,ft}{1\,mi} \times \frac{1\,h}{60\,min} \times \frac{1\,min}{60\,s} = 88\,\frac{ft}{s}$$

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

$$1.3 \times 10^{15}\,gal \times \frac{1\,d}{1.2 \times 10^9\,gal} = 1.08 \times 10^6\,d$$

11). How many minutes are in 180.0 days?

$$180.0\,d \times \frac{24\,h}{1\,d} \times \frac{60\,min}{1\,h} = 2.59 \times 10^5\,min$$

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

$$125\,lbs \times \frac{1\,kg}{2.2\,lbs} \times \frac{1000000\,mg}{1\,kg} = 5.68 \times 10^7\,mg$$

$$+$$

$$8\,oz \times \frac{1\,lb}{16\,oz} \times \frac{1\,kg}{2.2\,lbs} \times \frac{10^6\,mg}{1\,kg} = 2.27 \times 10^5\,mg$$

$$5.7 \times 10^7\,mg\ total$$

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

$$16.25\,\text{mi} \times \frac{1.00\,\text{km}}{0.621\,\text{mi}} \times \frac{1000\,\text{m}}{1\,\text{km}} \times \frac{100\,\text{cm}}{1\,\text{m}} = 2\,616\,747\,\text{cm}$$

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

$$6.30 \times 10^5\,\text{mm} \times \frac{1\,\text{m}}{1000\,\text{mm}} \times \frac{1\,\text{km}}{1000\,\text{m}} = 6.3 \times 10^{-1}\,\text{km}$$

in m next year!

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

$$\frac{3.00 \times 10^3\,\text{ft}}{1\,\text{s}} \times 18\,\text{min} \times \frac{60\,\text{s}}{1\,\text{min}} = 3.24 \times 10^6\,\text{ft}$$

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

$$\frac{14\,\text{bales}}{2\,\text{wk}} \times 1\,\text{yr} \times \frac{52\,\text{wk}}{1\,\text{yr}} = 364\,\text{bales}$$

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

$$\frac{0.8\,\text{yd}}{1\,\text{yr}} \times \frac{3\,\text{ft}}{1\,\text{yd}} \times \frac{12\,\text{in}}{1\,\text{ft}} \times \frac{2.54\,\text{cm}}{1\,\text{in}} = 73.2\,\text{cm}$$

18). If a swimmer swims 85.4 yards in five minutes, how many meters will s/he swim in 70.0 seconds? = 18.2 m

$$\frac{85.4\,\text{yd}}{5\,\text{min}} \times \frac{1\,\text{min}}{60\,\text{s}} \times 70.0\,\text{s} \times \frac{3\,\text{ft}}{1\,\text{yd}} \times \frac{12\,\text{in}}{1\,\text{ft}} \times \frac{2.54\,\text{cm}}{1\,\text{in}} \times \frac{1\,\text{m}}{100\,\text{cm}}$$

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

$$\frac{\$368.00}{1\,\text{oz}} \quad \$15 \times \frac{1\,\text{oz}}{\$368.00} \times \frac{1\,\text{lb}}{16\,\text{oz}} \times \frac{1\,\text{kg}}{2.2\,\text{lbs}} \times \frac{1000\,\text{g}}{1\,\text{kg}} = 1.16\,\text{g}$$

↑ started this way & realized it wasn't going to factor out.

1 ton = 2000 lbs 1 tonne = 1000 kg as opposed to METRIC TONNES

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

$$1.80\times10^{-4}\,\text{tons}\times\frac{2000\,\text{lbs}}{1\,\text{ton}}\times\frac{1\,\text{kg}}{2.2\,\text{lbs}}\times\frac{1000\,\text{g}}{1\,\text{kg}}=164\,\text{g}$$

21). A gas station is charging $1.299 per gallon of gas. What would be the price for a liter of gas? = $0.34

$$\frac{\$1.299}{1\,\text{gal}}\times\frac{264.2\,\text{gal}}{1\,\text{m}^3}\times\frac{1\,\text{m}}{100\,\text{cm}}\times\frac{1\,\text{m}}{100\,\text{cm}}\times\frac{1\,\text{m}}{100\,\text{cm}}\times\frac{1\,\text{cm}^3}{1\,\text{mL}}\times\frac{1000\,\text{mL}}{1\,\text{L}}$$

↑ length vs vol

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

$$8.35\times10^{6}\,\text{min}\times\frac{1\,\text{h}}{60\,\text{min}}\times\frac{1\,\text{d}}{24\,\text{h}}\times\frac{1\,\text{yr}}{365\,\text{d}}=1.59\times10^{-1}\,\text{yr}$$

15.9 yr

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

$$\frac{1\,\text{qt}}{2.70\,\text{kg}}\times\frac{1\,\text{kg}}{2.2\,\text{lbs}}\times100.0\,\text{lbs}=16.8\,\text{qt}$$

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

$$62\,\text{mo}\times\frac{30\,\text{d}}{1\,\text{mo}}\times\frac{24\,\text{h}}{1\,\text{d}}\times\frac{60\,\text{min}}{1\,\text{h}}\times\frac{60\,\text{s}}{1\,\text{min}}=1.61\times10^{8}\,\text{s}$$

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?

$$\frac{25.00\,\text{gal}}{400.0\,\text{km}}\times250.0\,\text{mi}\times\frac{1\,\text{km}}{0.621\,\text{mi}}=25.2\,\text{gal}$$

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

$$0.0054\,\text{wk}\times\frac{7\,\text{d}}{1\,\text{wk}}\times\frac{24\,\text{h}}{1\,\text{d}}\times\frac{60\,\text{min}}{1\,\text{h}}=54.4\,\text{min}$$

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

$$\frac{1\,\text{mi}}{7.35\,\text{s}}\times\frac{5280\,\text{ft}}{1\,\text{mi}}=718\,\frac{\text{ft}}{\text{s}}$$