Supplement A. Scientific problem solving using Dimensional Analysis

Unit Conversions Table* (will be provided in an exam)

Note: "1" is always exact and often not shown.

Length	Mass	Volume	Pressure	Energy
1 in = 2.54 cm (exact) 1 ft = 12 in (exact) 1 yd = 3 ft (exact) 1 mi = 5280 ft (exact)	1 lb = 453.6 g 1 kg = 2.205 lb 1 lb = 16 oz (exact)	1 L = 1.057 qt 1 gal = 3.785 L 1 ft^3 = 28.32 L 1 qt = 16 fl oz (exact) 1 gal = 4 qt (exact) ***memorize below:*** **1 mL = 1 cm^3** **1000 mL = 1 L**	1 atm = 14.696 psi 1 atm = 760 mmHg (exact) ***memorize below:*** **1 torr = 1 mmHg**	4.184 J = 1 cal 1 kWh = 3.60×10^6 J

*** Using this table you may need to use more than one conversion factor to convert to a desired unit!**

Memorize these unit abbreviations!
Pay attention to lower case and upper case letters

Abbreviation (in bold)

m : meters
in : inches
ft : feet
yd : yards
mi : miles
lb : pounds
kg : kilograms
oz : ounces
qt : quarts
gal : gallons
L : liters
ft^3 : cubic feet
fl oz : fluid ounces
atm : atmospheres
psi : pounds (force) per square inches
mmHg : millimeters of mercury
cal: calories (scientific)
Cal: Calories (food energy)
kWh: kilowatt-hour

Memorize these SI prefixes!

Prefix	abbreviation	value
pico	**p**	10^{-12}
nano	**n**	10^{-9}
micro		10^{-6}
milli	**m**	10^{-3}
centi	**c**	10^{-2}
deci	**d**	10^{-1}
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deka	**da**	10^{1}
hecto	**h**	10^{2}
kilo	**k**	10^{3}
mega	**M**	10^{6}
giga	**G**	10^{9}
tera	**T**	10^{12}

How do you set up dimensional analysis problems?
It is a good deal about good writing organization and cancellation of units!

You should convert each *equivalency* (listed in above table) to a ratio (unit factor) in any dimensional analysis problem solving. For example:

lbExample: 1 lb = 453.6 g (equivalency)

Unit factor (ratio) $\frac{\text{lb}}{\text{453.6 g}}$ or $\frac{\text{453.6 g}}{\text{lb}}$

The problem itself will determine which ratio is used. It is about cancellation of units!

When using dimensional analysis, be sure to start with a "?" followed by the desired unit(s) and the description of the quantity if appropriate and then an "=" sign followed by a fraction line divided into several ratios. You may only use one or more of the fractions. You may not have any quantity in the numerator or denominator of a fraction which is understood to be a "1". Learn to use the parenthesis feature of your calculator "(" and ")" to separate multiplication of denominator terms.

Be sure to use the scientific notation of your calculator when entering a number with scientific notation. **For "base 10" exponent press a button labeled "EXP" or "EE" followed by the exponent value. Don't forget to press the change sign button "±" to convert to a negative exponent. Some calculators (TI brands) show the change sign button as "(–)". The denominator to the left of "=" may be "1" or include units.**

$$\frac{\text{? unit(s) \& description}}{} = \frac{\quad}{\quad}\frac{\quad}{\quad}\frac{\quad}{\quad}\frac{\quad}{\quad} \ \ldots$$