

Dimensional Analysis (Conversion Factors)

<u>Reading:</u> Ch 1 section 8	<u>Homework:</u> Chapter 1: 89*, 91, 93, 95, 99, 103, 111*, 115
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* = 'important' homework question

Background

We do simple conversions between different units on a daily basis. For example:



Question:

How many eggs are there in 1 dozen eggs? _____



A statement such as this can be written as an *identity*

1 dozen eggs = 12 eggs

Recall: Is the above identity a measured or exact relationship? How would its use affect the number of significant figures used in any answer?

Using Identities and Conversion Factors

Question: How many eggs are there in 42 dozen eggs?



Use the appropriate identity to create a conversion factor. The conversion factor will transform the quantity into the desired form.


Math:

42 dozen eggs x _____ = _____



Conversion factors are simply identities written as fractions. Each conversion factor has two ‘versions’

Task: Complete the following table by transforming the stated identity into its two corresponding conversion factors. Also include at least three additional conversion factors that *you* have encountered.

Identity	Conversion factors		Exact? (Y/N)
1 in = 2.54* cm			
1 kg = 2.205 lb			
1 m = 100 cm			
1 ft = 12 inches			
			

Discussion:

How do you know which version of the conversion factor to use? Why?

For none exact identities and conversion factors, how many sig. figs are implied?

Example: Use the information from above to determine how many cm there are in 12.00 inches.

$$12.00 \text{ inches} \quad \times \quad = \underline{\hspace{2cm}}$$



The unit belonging to the quantity and the denominator of the conversion factor cancel to leave a final answer with the desired unit

Generic Form:

Extra Credit (3 pts., typed for next time): Dr. Mills gets *very* cranky with the text as it says “1 in = 2.54 cm *exactly*”. What is the source of Dr. Mills’ confusion? Hint: Is the inch really an S.I. unit? Try searching for ‘International inch’ to get started.

Task: Complete the following conversions. See your text for appropriate conversion identities.

5.51 cm to meters

23.0 ounces to pounds

50.0 nm to meters*

6.56 miles to km

45.7 inches to cm

220 pounds to kg

of drunk guys from 20
beers

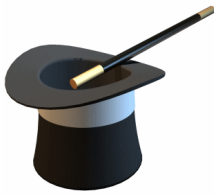


Conversion Factor ‘Chains’

Question: How do you approach a problem like “Convert 55 cm into feet” – where there is no available single conversion factor?

Answer:

$$55 \text{ cm} \times \quad \times \quad = \underline{\hspace{2cm}}$$



Link as many conversion factors as necessary together in order to create a ‘chain’. Each ‘link’ in the chain converts one unit to another and so on until the answer is reached

Task: Complete the following ‘chain’ conversions. See your text for appropriate conversion identities.

4.00 ounces to grams

1.68 m to inches

5.8 km to feet

Question of the week: How many atoms would have to be placed end to end in order to reach Chicago. Assume an atom is 0.15 nm wide and Chicago is 40.0 miles away.

Conversion factors:

'Chain' Math:



“The Wire”

The following questions were taken from your 1st practice midterm:

Question 1a (20 points) A spool of copper (Cu) wire has a mass of 2.00 pounds and a diameter of 50.0 μm . **Determine the wire’s mass, volume and length in the units specified below. Include any appropriate decimal prefixes in your final answers.** Assume density copper (Cu) = 8.95 gcm^{-3}

Mass of the wire in kg:

(ANS = 0.907 kg)

Volume of the wire in cm^3 :

(ANS = 101 cm^3)

Length of the wire in meters:

(ANS = $5.14 \times 10^4 \text{ m}$)