Announcements for Monday, 09SEP2024

For those who just recently joined the class:

- Check Canvas Announcements and e-mails often and read through all the posted material as soon as possible to get current with the class

For everyone:

- Homework Assignments available on Canvas
  - Week 1: Timed Quiz 1 – Math Skills due **tonight at 6:00 PM (EDT)**
  - Week 1: ALW application survey due **tonight at 11:59 PM (EDT)**
  - Week 2: **Readiness Assessment** will be **re-opened** on **Friday, 13SEP2024, for 24 hours**
  - Week 2: *Study Skills* and *Time Management* Digital Badge Assignments due **Friday, 13SEP2024, at 11:59 PM (EDT)**
  - Week 3: Beginning of Semester Chemistry surveys due **Monday, 16SEP2024, at 11:59 PM (EDT)**
  - Week 3: *Metacognition* Digital Badge Assignment due **Friday, 20SEP2024, at 11:59 PM (EDT)**
- In-person/online recitations begin this week
  - Students interested in ALWs should attend regular recitations until officially accepted
- First Day Course Materials – See Canvas announcement about opting-out (deadline: 17SEP2024)

ANY GENERAL QUESTIONS? Feel free to see me after class!

Answer to sig figs question

$$357.6 - 8.5\times10^4 + 42.4 = ?$$

$$
\begin{array}{rl}
357.6 & (\pm\ 0.1) \\
-\ \color{red}{85}000. & \color{red}{\text{(most uncertain, } \pm\ 1000)} \\
+\ \ 42.4 & (\pm\ 0.1) \\
\hline
\color{purple}{-84600.0} & = -\ 8.5\times10^4
\end{array}
$$

Density

What is density a measurement of?

- How packed-in matter is.
- it's the ratio of a substance's mass to its volume *at a given temperature*

- $\text{Density (d)} = \frac{\text{mass}}{\text{volume}} = \frac{\text{m}}{\text{V}}$
- it is a ***physical*** property (not a ***chemical*** property)
- it is an ***intensive*** property (not an ***extensive*** property)
  - **intensive property =** independent of the amount of substance
  - **extensive property =** ***Does*** depend on the amount of substance
- density can be used to identify pure substances (next slide)
- more importantly, density can be used as a **conversion factor**
  - converts mass $\leftrightarrow$ volume

density can be used to identify pure substances

TABLE E.4 The Density of Some Common Substances at 20 °C

Substance	Density (g/cm^3)
Charcoal (from oak)	0.57
Ethanol	0.789
Ice	0.917 (at 0 °C)
Water	1.00 (at 4 °C)
Sugar (sucrose)	1.58
Table salt (sodium chloride)	2.16
Glass	2.6

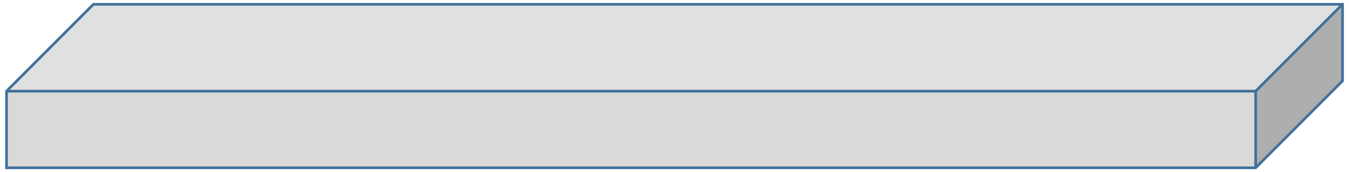
TABLE E.4 The Density of Some Common Substances at 20 °C

Substance	Density (g/cm^3)
Aluminum	2.70
Titanium	4.51
Iron	7.86
Copper	8.96
Lead	11.4
Mercury	13.55
Gold	19.3
Platinum	21.4

densities of liquids usually given in g/mL and solids usually in g/cm^3

Try this on your own…

A rectangular piece of metal 0.065 m long has a width of 0.64 cm and a thickness of 4.3 mm. The sample has a mass of 8.12 g. Identify the metal.



Substance	Density (g/cm^3)
aluminum	2.70
iron	7.86
titanium	4.51
platinum	21.4

Unit Conversions and Problem Solving

- **HUGELY IMPORTANT TOPIC**
  - the skills learned here will be used for the rest of this course (Chem I and Chem II)
  - remember stoichiometry?
  - all methods deal with working with and maintaining ratios/proportions

- The conversion factor approach to unit conversions
  - not the only way to do conversions, but it's the fastest
- the method depends on you properly creating and using **conversion factors (?!?)**
- a conversion factor is
  1. a ratio
  2. units on the top of the fraction are different from the units on the bottom of the fraction
  3. the top of the fraction is "equal" to the bottom
  4. created from an equality statement (i.e., 1 hour = 60 minutes…two conversion factors)

Conversion Factor Method

- you already know how to use conversion factors
  - example: ***how many hours in 2.0 days?***
  - conversion factor was based on 1 day = 24 h
  - starting point and units: 2.0 days
  - ending units: hours
  - multiply your starting point by conversion factor(s) so that final unit becomes hours
- how many nanoseconds in 3.0 days?
  - same approach as first question but more conversion factors needed

$$3.0\ days \times \frac{24\ hr}{1\ day} \times \frac{60\ min}{1\ hr} \times \frac{60\ s}{1\ min} \times \frac{10^9\ ns}{1\ s} = 2.6 \times 10^{14}\ ns$$

- steps to solve the problem
  - what are the units of your starting point, the given?
  - what are the units of the final answer?
  - what conversion factors are provided or memorized?

Conversion Factor Method (continued)

- The math is identical to setting up a proportion and solving for x
- The approaches are distinct and different however
- choose one approach and stick with it

conversion factor approach: $2.0\ days \times \frac{24\ hours}{1\ day} = 48\ hours$

starting point

conversion factor

ending units

same answer!

setting up a proportion: $\frac{x\ hours}{2.0\ days} = \frac{24\ hours}{1\ day}$ and solving for x: $(x\ hours)(1\ day) = (2.0\ days)(24\ hours)$

$$x = \frac{(2.0\ days)(24\ hours)}{(1\ day)} = 48\ hours$$

Unit Conversions and Problem Solving

- convert 8.66 pL into nm^3 (1 mL = 1 cm^3)

$$8.66\ \text{pL} \times \frac{1\ \text{L}}{10^{12}\ \text{pL}} \times \frac{1000\ \text{mL}}{1\ \text{L}} \times \frac{1\ \text{cm}^3}{1\ \text{mL}} \times \frac{1^3\ \text{m}^3}{100^3\ \text{cm}^3} \times \frac{(10^9)^3\ \text{nm}^3}{1^3\ \text{m}^3} = \mathbf{8.66 \times 10^{12}\ \ nm^3}$$

- a drop of gasoline has a mass of 22 mg and a density of 0.754 g/cm^3. What is the volume of the drop in microliters (μL)?

$$22\ \text{mg} \times \frac{1\ \text{g}}{1000\ \text{mg}} \times \frac{1\ \text{cm}^3}{0.754\ \text{g}} \times \frac{1\ \text{mL}}{1\ \text{cm}^3} \times \frac{1\ \text{L}}{1000\ \text{mL}} \times \frac{10^6\ \mu\text{L}}{1\ \text{L}} = \mathbf{29\ \mu L}$$

- a bottle of Excedrin contains 100 tablets where each tablet contains 65.0 mg caffeine. A 16-ounce can of Red Bull contains 0.148 g caffeine. How many bottles of Excedrin must be ingested to provide the same amount of caffeine as in 6 dozen cases of Red Bull (where a case contains 24 16-ounce cans)?

$$6\ \text{dozen cases RB} \times \frac{12\ \text{cases}}{1\ \text{dozen}} \times \frac{24\ \text{cans}}{1\ \text{case}} \times \frac{0.148\ \text{g caffeine}}{1\ \text{can RB}} \times \frac{1000\ \text{mg}}{1\ \text{g}} \times \frac{1\ \text{tablet Exced}}{65.0\ \text{mg caffeine}} \times \frac{1\ \text{bottle}}{100\ \text{tablets}} = \mathbf{39.3\ bottles}$$

The Conversion Factor Approach to Problem Solving

(answers provided next lecture)

- convert 568 cm to yards (2.54 cm = 1 in)

- What is the volume, in nm^3, of a 155.6 lb-sample of pure copper given that the density of copper = 8.96 g/cm^3 and 1.000 lb = 453.6 g?

- The wheel of a child's tricycle has 12 metal spokes, and each spoke has a mass of 15 g. What mass of metal, in kg, is needed to provide enough material for the spokes in 2.5 dozen tricycles?

- A sunscreen preparation contains 2.50% benzyl salicylate by mass (in other words, there are 2.50 g of benzyl salicylate in every 100 g of sunscreen). If a tube contains 4.0 ounces of sunscreen, how many kilograms of benzyl salicylate are needed to manufacture 325 tubes of sunscreen? 16 ounces = 453.6 g