AP Chemistry Summer Assignment **Summer 2022**

Congratulations on deciding to take AP Chemistry!

Over the summer, I am SUGGESTING that you complete this packet. It is OPTIONAL. However, it would be a good way to refresh your skills prior to coming back to school. This assignment is to help refresh material that will be essential, and used, throughout the year.

If you have any questions or problems, you may contact me via e-mail at rdarr@fcps.edu. Please do not wait until the last minute to begin or to receive clarification about the assignment.
Enjoy your summer!

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AP Chemistry Summer Review

1. **Exact Numbers:**

Counted numbers and *definitions* do not involve any measurement and are considered asexact numbers with an infinite number of significant figures. Do not consider them when determining significant figures for your final answer.

Definitions: 1 week = 7 days.
1 mile = 5,280 feet
1 yard = 3 feet

Counted: 5 Players on the basketball court.
23 students in a room
25 ennies used by a class in an experiment.

2. **Measured Numbers:**

All ***measured numbers*** have some degree of uncertainty.

When recording measurements, ***record only the significant figures.*** Record measurementsto include one decimal estimate beyond the smallest increment on the measuring device.

Examples (consider a measuring instrument like a ruler):

- If smallest increment = 1m, then record measurement 0.1m (i.e. 3.1**m)**
- If smallest increment= 0.1m, then record measurement to 0.01m (i.e. 5.67 **m)**
- If smallest increment= 0.01m, then record measurement to 0.001m (i.e.12.675 **m)**

c. Unless otherwise stated the uncertainty in the last significant figure *(the uncertain digit)* is assumed to be ±1 unit. Modern digital instruments and many types of volumetric glassware will state the level of uncertainty.

3. Rules for counting Significant Figures.

a.Non-Zero Numbers: Non-zero numbers are always significant.
b. ***Zeros:***

1: **Leading zeros** that come before the first non-zero number are ***never*** significant
2. **Captive zeros** *(sandwich* zeros) that fall between two non-zero digits are ***always*** significant.
3. **Ending zeros** thatappear after the last non-zero digit are significant only when a decimalpoint appears somewhere in the number.

4. Rules for Using Significant Figures in Calculations

a. Multiplication, Division. Powers and Roots:-"LEAST SIG.FIG RULE"

1. The result should be reported to the same number of significant figures as the measurednumber having the **/east *number of significant figures.***

2. Only consider the number of significant figures in each of the ***measured numbers! (not constants)***

Example: 2.3 x 5.78 =*Calculator returns* 13.294

2.3 *has 2 sig fig*

5.78 *has 3 sig fig*

2.3 x 5.78 = 13 *The answer must be rounded to show 2 sig fig*

b. Addition and Subtraction: ***"LEAST PRECISE DECIMAL RULE"***

1. The result should be reported with the same decimal precision as the measured numberhaving the uncertain digit in the ***least precise decimal place.***

2. Only consider the decimal precision in each of the ***measured numbers! (not constants)***

Problems

How many significant figures in the following numbers:

1. 1,245 m
2. 0.030 m
3. 10,000 m
4. 1.340×10^{23} m
5. 3.02003×10^{14} m
6. 0.0000001 m
7. 1,000.
8. 0.10000010

Problems 9 - 11: Perform the following Calculations and record your answers in the proper number of significant figures and units.

9. 0.6030 s + 0.82 s =
10. 4.l m + 0.3789 m - 153.22 m =
11. 0.307 g / 1.0×10^{-3} mL

Part II: Simple Metric Conversions and Consistent Units

Section 1: Metric Conversions

Make the following conversions - preserve the number of significant figures in the answer!

1. 34 km → _____cm

2. 43,000 mm → _____km

3. 4.0×10^{6} nm → _____km

4. 3.98×10^{-3} km → _____dm

5. 456 mm → _____km

6. 136,000 m → _____km

7. 450 nm → _____mm

Unit Multiplication - Dimensional Analysis - Factor Labeling

Units:

In the world of mathematics numbers often exist as abstract and unitless entities. However, in the world of physics and chemistry where numbers are based upon experimentation and measurement, all numbers are based on a physical reality. ***As a result, every number consists of two important parts.*** The first is a **magnitude** and the second equally important part is a **unit. It** is the unit that gives physical, real-world meaning to the number. We never write one without the other!

Examples: Note that these are all "equivalence statements"!

12 ***inches*** in one ***foot***
365 ***days*** in one ***year***
7 days in one ***week***

Derived Units and Calculations

Many of the common units we use are actually derived units that result from performing mathematical operations on the basic units. ***When performing mathematical operations the units are treated and manipulated as if they were algebraic variables.***

Unit Conversions

It is often necessary to convert from one system of units to another. The most efficient way to do thisis using a process known as *"unit multiplication", "factor labeling"* or *"dimensional analysis".*

"goal posting"

One useful version of this method is called "goal posting''. ***Step 1:*** Draw a *"goal post* "with the horizontal bar extending on each side. ***Step 2:*** Place the original number and unit to the left. ·Placethe final unit on the right. ***Step 3:*** Move the original unit (cm) from the top left *(numerator)* to the bottom of the conversion factor (*denominator).* Now there is no confusion about which form of the conversion factor you will use. If you have done this correctly the original units on the top (cm) will be canceled by the same unit in the denominator of the conversion factor.

Dimensional Analysis Practice Problems

1. I have 470 milligrams of table salt, which is the chemical compound NaCl. How many liters of NaCl solution can I make if I want the solution to be 0.90% NaCl? (9 grams of salt per 1000 grams of solution).

The density of the NaCl solution is 1.0 g solution/mL solution.

2. I have a bar of gold that is 7.0 **in** x 4.0 **in** x 3.0 **in.** The density of gold is 19.3 g/cm^3.
The price of gold currently is $1,945.94 per ounce. How much is my gold bar worth?

3. The roof of a building is 0.2 km^2. During a rainstorm, 5.5 cm of rain was measured to be sitting on the roof. What is the mass in kg of the water on the roof after the rainstorm? (Density of rainwater = 1 g/mL).

4. The bromine content of the ocean is about 65 g of bromine per million g of seawater. How many mL of ocean must be processed to recover 500. mg of bromine, if the density of seawater is 1.0×10^3 kg/m^3?

5. Light travels 186,000 miles/second. How long is a light-year in meters? (1 light-year is the distance light travels in one year)