Fivay High School
AP Chemistry Summer Assignment
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This summer assignment is designed to refresh the skills you will need to have success in Advanced Placement Chemistry. This assignment *will not* be graded. However, on the first day of school, you will take a test that covers the material contained in this assignment. It is the ability to responsibly work through self-identified difficulties that defines successful AP students. All of the material contained below should be familiar to you. If it is not, please use any resource available, including sending me an email (clorich@pasco.k12.fl.us) to work through your difficulties. The skills to complete these problems are essential.

Algebra skills:

You must be able to swiftly complete basic algebraic manipulations for many chemistry problems. If you are rusty or slow, practice them. For each given equation, isolate every variable. Simplify the solution.

Example: $ax = by$

$a = \frac{by}{x}$, $x = \frac{by}{a}$, $b = \frac{ax}{y}$, $y = \frac{ax}{b}$

Problems:

$\frac{x}{y} = z$	$\frac{1}{x} = \frac{1}{z}$	$\sqrt{x} = \frac{y}{z}$
$\frac{x}{y} = \frac{z}{w}$	$\frac{1}{x} = \frac{1}{z} - \frac{1}{w}$	$\sqrt{w + x} = \frac{y}{z}$
$\frac{1}{x} = z$	$ax^2 = \frac{y}{z}$	$\sqrt{w} + \sqrt{x} = \frac{y}{z}$

Significant figures and Rounding:

(https://www.khanacademy.org/math/arithmetic/decimals/significant_figures_tutorial/v/significant-figures)

I expect that you will have a firm grasp of significant figures. If you do not, please use the linked Khan Academy video. You may also search the Internet, as there are hundreds of websites dedicated to the use of sigfigs.
With regard to rounding, you have undoubtedly been taught the following method:

When a 5 or higher follows the digit to which you're rounding, round up.
Example: 925 rounds to 930.
When a 4 or lower follows the digit to which you're rounding, round down.
Example: 922 round to 920.

In large scientific data sets, however, the standard method of rounding can cause problems. Consider the following series of numbers from 921 to 929 (exclude the the tens since they do not get rounded):

Original number	Rounded number
921	920
922	920
923	920
924	920
925	930
926	930
927	930
928	930
929	930

Note that 4 of the 9 numbers have been rounded down and 5 of the 9 numbers have been rounded up. The average of the original numbers is 925. The average of the rounded numbers is 925.5555… While this may seem like a small deviation, your rounding method should not alter the value of your data. Extended over a data set that contains tens of thousands of data points, all of these small deviations can add up to major problems.

The problem with this rounding method comes from the fact that 5 is exactly in the middle, but it always rounds up. To account for that bias, we use the even odd method. It only affects rounding when the digit following the one to which you are rounding is a 5. For any other digit, follow the rules you already know. Here's what to do:

When the digit following your rounding digit is a 5 and your digit is even, leave it alone. When the rounding digit is odd, round up. Here are some examples:

Number	Rounds to
924	920
926	930
925	920
934	930
936	940
935	940
1.305	1.30
1.315	1.32

Scientific notation:

Chemical quantities are often very large or very small quantities. You must be able to work with numbers in scientific notation and swiftly convert them to standard notation when necessary. ***Complete the following problems without using a calculator****. Report your answer in scientific notation only. Report your answer with two significant figures.*

0.000000004356	1420000000	2000
235	2450	1.95
$2.0 \times 10^6 \times 4.0 \times 10^3$	$2.0 \times 10^6 \times 4.0 \times 10^{-3}$	$(3.0 \times 10^3)^2$
$\frac{4.0 \times 10^6}{2.0 \times 10^3}$	$\frac{3.0 \times 10^6}{9.0 \times 10^3}$	$\frac{4.0 \times 10^3}{2.0 \times 10^8}$

Measurement and Unit Conversions:

Once you have taken appropriate measurements, they must often be converted to another unit in order to perform calculations. Complete the unit conversion problems below.

You must be thoroughly familiar with the metric system and its standard units of measurement. Those most frequently used in chemistry are (both basic and derived):

Unit	What it measures
meter (m)	length
second (s)	time
kilogram (kg)	mass
Kelvin (K)	temperature
Joule (J)	energy
Pascal (Pa)	pressure
Watt (W)	power
Liter (L)	volume
mole	quantity
molarity (M)	concentration

Due to the very large or very small quantities often encountered in chemistry, prefixes are often applied to these basic measurements for the sake of more convenient numbers. You will not be tested on the prefixes in gray, but they are still important to know about. You are expected to know the rest without hesitation, and to swiftly convert from one to another. Mistakes in unit conversion should never be a reason to come to an incorrect solution to a problem.

Prefix	What it means	Scientific notation
yotta (Y)	1,000,000,000,000,000,000,000,000	1×10^{24}
zetta (Z)	1,000,000,000,000,000,000,000	1×10^{21}
exa (E)	1,000,000,000,000,000,000	1×10^{18}
peta (P)	1,000,000,000,000,000	1×10^{15}
tera (T)	1,000,000,000,000	1×10^{12}
giga (G)	1,000,000,000	1×10^{9}
mega (M)	1,000,000	1×10^{6}
kilo (k)	1,000	1×10^{3}
hecto (h)	100	1×10^{2}
deca (da)	10	1×10^{1}
(no prefix)	1	1×10^{0}
deci (d)	$\frac{1}{10}$	1×10^{-1}
centi (c)	$\frac{1}{100}$	1×10^{-2}
mili (m)	$\frac{1}{1,000}$	1×10^{-3}
micro (μ)	$\frac{1}{1,000,000}$	1×10^{-6}
nano (n)	$\frac{1}{1,000,000,000}$	1×10^{-9}
pico (p)	$\frac{1}{1,000,000,000,000}$	1×10^{-12}
femto (f)	$\frac{1}{1,000,000,000,000,000}$	1×10^{-15}
atto (a)	$\frac{1}{1,000,000,000,000,000,000}$	1×10^{-18}
zepto (z)	$\frac{1}{1,000,000,000,000,000,000,000}$	1×10^{-21}
yocto (y)	$\frac{1}{1,000,000,000,000,000,000,000,000}$	1×10^{-24}

Polyatomic Ions:

In chemistry or chemistry honors, you were required to memorize a few polyatomic ions. That number has now increased. You must know all of these ions, their names and their charges without having to consult reference materials. I could not fit them neatly on a single page; Be careful not to omit the few on the next page. These ions are listed alphabetically. I suggest you group them for similarities (all of the ates, ites, hypo-ites) when working on memorization.

Ion	**Formula**
acetate	$C_2H_3O_2^-$ or CH_3COO^-
amide	NH_2^-
ammonium	NH_4^+
arsenate	AsO_4^{3-}
arsenite	AsO_3^{3-}
bismuthate	BiO_3^-
bromate	BrO_3^-
bromite	BrO_2^-
carbonate	CO_3^-
chlorate	ClO_3^-
chlorite	ClO_2^-
chromate	CrO_4^{2-}
cyanide	CN^-
dichromate	$Cr_2O_7^{2-}$
dihydrogen phosphate	$H_2PO_4^-$
hydrogen carbonate (bicarbonate)	HCO_3^-
hydrogen phosphate	HPO_4^{2-}
hydrogen sulfate (bisulfate)	HSO_4^-
hydroxide	OH^-
hypobromite	BrO^-
hypochlorite	ClO^-
hypoiodite	IO^-
iodate	IO_3^-
iodite	IO_2^-
nitrate	NO_3^-
nitrite	NO_2^-
oxalate	$C_2O_4^{2-}$
perbromate	BrO_4^-
perchlorate	ClO_4^-
periodate	IO_4^-
permanganate	$KMnO_4^-$
peroxide	O_2^{2-}
phosphate	PO_4^-
selenate	SeO_4^{2-}
selenite	SeO_3^{2-}
sulfate	SO_4^{2-}

sulfite	SO_3^{2-}
tartrate	$C_4H_4O_6^{2-}$
tellurate	TeO_4^{2-}
tellurite	TeO_3^{2-}
thoicyanate	SCN^-
thoisulfate	$S_2O_3^{2-}$

Nomenclature:

You cannot investigate equations or calculations about a substance without knowing its chemical formula. Give the formula below when the compound name is given. Give the compound name when the formula is given.

1. Lead (II) sulfide
2. Zinc phosphide
3. Gallium chloride
4. Silver bromide
5. Cesium fluoride
6. Lead (IV) nitride
7. Cobalt (II) fluoride
8. Chromium (III) telluride
9. Silicon dioxide
10. Diphosphorus trioxide
11. Phosphorus pentachloride
12. Silicon Dioxide
13. Cs_2S
14. $CoCl_2$
15. LiBr
16. NaF
17. SnF_2
18. Ag_2O
19. Ni_2O_3
20. Cr_2O_3
21. Sb_3P_5
22. N_2O_4
23. B_2O_3
24. SiO_2
25. K_3PO_4
26. $Cr_2(HPO_4)_3$
27. CuSCN
28. NaCN
29. $CoBO_3$
30. $KMnO_4$
31. $Li_2Cr_2O_4$
32. $Sb_3(PO_3)_5$
33. Zinc hydroxide
34. Cesium dichromate
35. Lithium thiosulfate
36. Strontium thiocyanate
37. Cadmium chromate
38. Copper (I) acetate
39. Sodium perchlorate
40. Manganese (IV) sulfate
41. H_2SO_4
42. HCN
43. H_3BO_3
44. HF
45. H_2CrO_4
46. HCH_3COO
47. Sulfurous acid
48. Nitric acid
49. Hydrotelluric acid
50. Selenic acid
51. Permanganic acid
52. Chlorous acid

Equation Balancing:

You must be able to work with an equation and balance it in order to complete most of the investigations in this course. Complete and balance the equations below.

1. When solid calcium carbonate is heated, solid calcium oxide and gaseous carbon dioxide are produced.
2. Aluminum metal reacts with oxygen gas to form solid aluminum oxide.
3. Aqueous solutions of barium chloride and sulfuric acid are mixed to produce a precipitate of barium sulfate and aqueous hydrochloric acid.
4. Bubbles of hydrogen gas and aqueous iron (III) chloride are produced when metallic iron is dropped into hydrochloric acid.
5. Solid tetraphosphorus decoxide reacts with water to produce phosphoric acid.
6. Heating sulfuric acid produces water, oxygen and sulfur dioxide gas.
7. Hexane (C_6H_{14}) burns in the presence of oxygen.

Stoichiometry:

Knowing the amount of each substance involved in a chemical reaction is essential to understanding equilibrium. Complete the following stoichiometry problems.

1. When heated, sodium bicarbonate decomposes into sodium carbonate, water and carbon dioxide. If 5.00 g of sodium bicarbonate decomposes, what is the mass of each product produced (assume 100% yield).
2. Calcium phosphate reacts with silicon dioxide and elemental carbon to produce calcium silicate, elemental phosphorus and carbon monoxide. If the percent yield of this reaction is 81.3%, how many grams of calcium phosphate must you start with in order to produce 422 L of carbon monoxide at STP?
3. Ammonia reacts with oxygen gas to form nitrogen monoxide and water. If 173 grams of ammonia reacts with 216 grams of oxygen, how many grams of each product are formed (assume a 71.4% yield)?