Name_____
AP Chemistry Summer Assignment

Dear Students,

Welcome to Advanced Placement Chemistry! My name is Ms. Harris, formally Ms. Esswein. Before becoming a science teacher, I worked in industry namely in the fields of material science and geochemistry. Working in research labs, training graduate students, maintaining instruments, collecting data and writing papers are all the skills of a scientist that I look forward to sharing with you all.

The purpose of this summer assignment is to ensure that you are ready to begin the AP Chemistry journey this year. Studying on a daily basis is extremely important in AP Chemistry and I want you to start working on this habit over the summer with this assignment. Please read through the sections below before beginning the practice problems.

Sincerely,
Ms. Harris

Assessment:
Your first test will be given within the first few weeks of school and will consist of the following:
1. A grade for the completion of this summer assignment. You will not receive full credit if you do not show work. (30%)
2. Unit 1 Exam consisting of topics covered in the summer assignment as well as other fundamental concepts covered in class. (70%)

Online Resources:
Here are some online resources if you get stuck on a topic.

1- Tyler DeWitt
https://www.youtube.com/channel/UCj3EXpr5v35g3peVWnVLoew

2- Bozeman Science
https://www.youtube.com/user/bozemanbiology

3- Michael Farabaugh
https://www.youtube.com/channel/UCuS6lUi8mITtAZnUytu77Kg

4- Khan Academy
https://www.khanacademy.org/science/ap-chemistry

Summer Assignment:

Task 1: Complete Practice Problems (attached)

Task 2: Memorize the names of the elements and their corresponding symbols

- You need to know elements 1-56, plus Pt, Au, Hg, Pb, Rn, Fr, Ra, U, Pu
- Many of these elements you will already know

Task 3: Memorize the ionic charges of the basic ions

- Think about the valance electrons
- Think about the common elements/ions in that group
  - Group 1 ions = +1
  - Group 2 ions = +2
  - Group 15 (5A) ions (N and P) = -3
  - Group 16 (6A) ions (O and S) = -2
  - Group 17 (7A)/ halogens = -1
  - Zn = +2
  - Ag = +1
  - Cu = +1 or +2
  - Fe = +2 or +3
  - Pb = +2 or +4
  - Sn = +2 or +4

Task 4: Memorize the names, symbols, and charges of Polyatomic ions below:

- Oxyanions – polyatomics containing oxygen, names end in –ate or –ite
- -*ate* is used for the most common form
- -*ite* is used for the form with the same charge, but one less oxygen
  - Example:
    - NO_3^- = nitrate
    - NO_2^- = nitrite
- Prefixes are also used
  - *Per*- indicates one more oxygen than the –*ate* form (think "perfect = overachieving", ie = more)
  - *Hypo*- indicates one fewer oxygen than the –*ite* form
  - Example:
    - ClO_4^- = perchlorate (b/c it has one more O than the –ate form)
    - ClO_3^- = chlorate (b/c it is the most common)
    - ClO_2^- = chlorite (b/c it has one less oxygen than – ate form)
    - ClO^- = hypochlorite (b/c it has one less oxygen than the –ite form)
  - F, Cl, Br, I all behave the same
    - Therefore, if chlorate is ClO_3^-, the bromate ion is… BrO_3^-
    - Simply substitute one halogen for the other
    - If you learn the chlorate series, you also automatically know the bromate, iodate, and fluorate series
- Hydrogen can be added to -2 or -3 ions to make a "new ion" i.e. $H_2PO_4^{-1}$ is dihydrogen phosphate (note the – charge went up 1 for each H^+ added)

Practice Problems

Significant Figures (Sig Figs)

1. How many sig figs are in the following numbers?
a) 0.0450 _____
b) 790 _____
c) 32.10 _____
d) 10,305.00 _____

2. Solve the following problems. Round your answer to the correct number of sig figs (and use the correct unit on your answer).

a) (825 cm) x (32 cm) x (0.248 cm) _____

b) (15.68 g) / (2.885 mL) _____

c) (150.80 g) / (0.080 mL) _____

d) (0.030 cm) x (0.20 cm) x (0.048 cm) _____

Density
(round your answers to correct number of sig figs and show all work with units)

3. A cube of ruthenium metal 1.5 cm on a side has a mass of 42.0 g. What is the density in g/cm^3? Will ruthenium metal float on water?

4. The density of bismuth metal is 9.8 g/cm^3 . What is the mass of a sample of bismuth that displaces 65.8 mL of water?

Conversions
(round answers correctly and show work with units)

5. Make the following conversions:

a) 16.2 m to km

b) 5.44 nL to mL

c) 45.7 mL/s to kL/hr

d) 0.045 cm^3 to L

e) 103.6 mg to g

Reactions

6. Balance the following and equations and tell what type of reaction it is (synthesis, decomposition, single replacement, double replacement, or combustion)

a) ___ KNO_3 → ___ KNO_2 + ___ O_2 Type: _____

b) ___ $AgNO_3$ + ___ K_2SO_4 → ___ Ag_2SO_4 + ___ KNO_3 Type: _____

c) ___ CH_3NH_2 + ___ O_2 → ___ CO_2 + ___H_2O + ___ N_2 Type: _____

d) ___ N_2O_5 + ___ H_2O → ___HNO_3 Type: _____

e) ___ Na + ___ $Zn(NO_3)_2$ → ___ Zn + ___ $NaNO_3$ Type: _____

7. What are diatomic molecules? List all 7.

Average Atomic Mass

8. Magnesium consists of 3 naturally occurring isotopes with the masses 23.98504, 24.98584, and 25.98259 amu. The relative abundances of these three isotopes are 78.70%, 10.13 %, and 11.17% respectively. Calculate the average atomic mass.

Percent Composition

9. Calculate the percent composition of $C_{12}H_{22}O_{11}$ (sugar). (Give Percent of each element.) Show all work.

Moles

10. Calculate the number of moles of the following: (SHOW WORK)

a) 42.8 g of KNO_3

b) 155.7 L of CO_2 at STP

c) 9.25×10^{26} molecules of $CaCl_2$

Stoichiometry

11. Using the following equation: $2\ NaOH + H_2SO_4 \rightarrow 2\ H_2O + Na_2SO_4$ How many grams of sodium sulfate will be formed if you start with 200 grams of sodium hydroxide and you have an excess of sulfuric acid?

12. Using the following equation: $Pb(SO_4)_2 + 4\ LiNO_3 \rightarrow Pb(NO_3)_4 + 2\ Li_2SO_4$ How many grams of lithium nitrate will be needed to make 250 grams of lithium sulfate, assuming that you have an adequate amount of lead (IV) sulfate to do the reaction?

13. Using the following equation: $Fe_2O_3 + 3\ H_2 \rightarrow 2\ Fe + 3\ H_2O$ Calculate how many grams of iron can be made from 16.5 grams of Fe_2O_3.

14. In a spacecraft, the carbon dioxide exhaled by astronauts can be removed by its reaction with lithium hydroxide, LiOH, according to the following chemical equation. If 20.0 moles of CO_2 is exhaled, the average amount exhaled by a person each day, how much (in grams) $Li_2CO_3(s)$ is produced?

$CO_2(g) + 2LiOH(s) \rightarrow Li_2CO_3(s) + H_2O(l)$

15. Given the following unbalanced equation determine parts a-c.

_____ C_4H_{10} + _____ O_2 ---> _____ CO_2 + _____ H_2O

a) When 0.624 moles of O_2 are reacted, how many moles of carbon dioxide are produced?

b) How many grams of C_4H_{10} are needed to produce 3.7 moles of water?

c) What volume of O_2 gas is needed to react with 2.56 g of C_4H_{10}?

Limiting Reactant & Percent Yield

16. Determine the grams of sodium chloride produced when 10.0 g of sodium react with 10.0 g of chlorine gas according to the equation below. Which reactant was limiting?

$2\ Na + Cl_2 \rightarrow 2\ NaCl$

17. Determine the mass of lithium hydroxide produced when 50.0g of lithium are reacted with 45.0g of water according to the equation below. Which reactant was limiting?

$2\ Li + 2\ H_2O \rightarrow 2\ LiOH + H_2$

18. Nitric oxide (NO) reacts with oxygen gas to form nitrogen dioxide (NO_2), a dark brown gas in the reaction below. In one experiment 0.866 mol of NO is mixed with 0.503 mol of O_2. Determine the mass of NO_2 produced and which reactant was limiting.

$2NO(g) + O_2 \rightarrow 2NO_2$

19. Determine the percent yield of water produced when 68.3 g of hydrogen reacts with 85.4g of oxygen and 86.4g of water are collected.

$2\ H_2 + O_2 \rightarrow 2\ H_2O$

20. According to the following unbalance equation, calculate the percentage yield if 550.0 g of toluene (C_7H_8) added to an excess of nitric acid (HNO_3) provides 305 g of the p-nitrotoluene ($C_7H_7NO_2$) product in a lab experiment.

$\_\_\_C_7H_8 + \_\_\_HNO_3 \rightarrow \_\_\_C_7H_7NO_2 + \_\_\_H_2O$

21. A student adds 200.0g of $C_7H_6O_3$ to an excess of $C_4H_6O_3$, this produces $C_9H_8O_4$ and $C_2H_4O_2$. Calculate the percent yield if 231 g of aspirin ($C_9H_8O_4$) is produced in an experiment.

$\_\_\_C_7H_6O_3 + \_\_\_C_4H_6O_3 \rightarrow \_\_\_C_9H_8O_4 + \_\_\_C_2H_4O_2$

Formula Writing and Naming

22.Provide names for the following ionic compounds:

a. AlF_3

b. $Fe(OH)_2$

c. $Cu(NO_3)_2$

d. $Ba(ClO_4)_2$

e. Li_3PO_4

f. Hg_2S

g. $Cr_2(CO_3)_3$

h. $(NH_4)_2SO_4$

23. Write the chemical formulas for the following compounds:

a. Copper(I) oxide

b. Potassium peroxide

c. Iron(III) carbonate

d. Zinc nitrate

e. Sodium hypobromite

f. Aluminum hydroxide

24. Give the name or chemical formula for each of the following molecular substances:

a. SF_6

b. XeO_3

c. Dinitrogen tetroxide

d. Hydrogen cyanide

e. IF_5

f. Dihydrogen monoxide

g. Tetraphosphorous hexasulfide

25. Give the name or chemical formula for the following compounds:

a. Ammonium oxalate

b. Manganese(III) dichromate

c. $Ti(OH)_4$

d. $Ni(ClO_2)_3$

e. Dinitrogen pentoxide

f. Aluminum oxide

g. Fe_2S_3

26. Name the following acids

a. $H_2C_2O_4$

b. $HBrO_3$

c. HBr

d. HNO_2

e. H_2SO_4

27. Write formulas for the following acids.

a. hydrochloric acid

b. sulfuric acid

c. nitric acid

d. phosphoric acid

e. carbonic acid

f. acetic acid