AP Chemistry Summer Assignment   **May 2015**

Future AP Chemistry Student,

Welcome to AP Chemistry! In order for us to have the most successful year possible in AP Chemistry, we will need to be able to jump right in to new topics when we get back to school. In order to do that, you need to review and practice topics from first year chemistry over the summer. Most of the problems that you need to work on are things that we have already learned, but if you need help, remember to check out the websites listed below. There may be a few things that you will need to look up for the first time.

AP Chemistry will move at a fast pace and will be more rigorous than first year chemistry so that we can be prepared for the AP exam in May. We also will be spending more time on in-depth labs and lab reports. To get started at the right pace, you need to make sure this summer assignment is done completely and on time. Remember that you are the only one who will be taking your summative assessments this year, and you are the only one who will take your AP exam, so you should do all of your own work on the summer assignment.

Completed work must be submitted on the first day of school. Late work will receive a maximum score of 75%.

Review websites for general chemistry

GPB Chemistry and Physics: http://www.gpb.org/chemistry-physics/students/all
Khan Academy: https://www.khanacademy.org/science/chemistry

Balancing equations practice web links

http://science.widener.edu/svb/tutorial/rxnbalancingcsn7.html
http://www.chemistry-drills.com/balance.html

SHOW WORK FOR ALL PROBLEMS.   USE SIGNIFICANT DIGITS.   Some problems will need to be done on your own paper and attached.

1. Write the **most common guidelines** to determine significant figures (digits) with examples for adding/subtracting and multiplying/dividing?

2. Use **dimensional analysis** to convert the following:
    a. 200 meters = ___ miles.
    b. 650 in = ____ meters
    c. 4 years= _____ seconds.
    d. 200 liters = _____ ml

3. Classify each of the following as units of mass, volume, length, density, energy, or pressure.
    a.Kg   b. Liter   c. m^3 d. mm   e. kg/m^3
    f. J   g. atm   h. cal   i.Torr   j. g/ml

4. Most laboratory experiments are performed at room temperature at 65˚C. Express this temperature in:
    a. ˚F   b. K

5. How many **significant figures** are in each of the following?
    a. 1.9200 mm   b. 0.0301001 kJ   c. 6.022 x10^{23} atoms   d. 460.000 L
    e. 0.000036 cm^3 f. 10000   g.1001   h. 0.001345
    i. 0.0101   j. 3.02 x 10^4 k. 3.21 x 10^{-2}

6. Record the following in correct **scientific notation**:
    a. 4050,000,000 cal
    b. 0.000123 mol
    c. 0.00345 Å
    d. 700,000,000 atoms

7. Calculate the following to the **correct number** of significant figures.
    a. 1.270 g / 5.296 cm^3
    b. 12.235 g / 1.010 L
    c. 12 g + 0.38 g
    d. 170g + 2.785 g
    e. 2.1 x 3.2102
    f. 200.1 x 120
    g. 17.6 + 2.838 + 2.3 + 200

8. Write **the latin** names for each of the elements symbols:
    a. Na   b. Au   c. Ag   d. Sn   e. Fe   f. Hg   g. K   h. Pb

9. Label each of the following as either a **physical process** or a **chemical process**.
    a. Corrosion of aluminum metal.
    b. Melting of ice.
    c. Pulverizing an aspirin.
    d. Digesting a candy bar.
    e. Explosion of nitroglycerin.
    f. Milk turning sour.
    g. Burning of paper.
    h. Forming of frost on a cold night.
    i. Bleaching of hair with hydrogen peroxide.
    j. A copper wire is hammered flat.

10. You may notice when water boils, you can see bubbles that rise to the surface of the water.
    a.   What is inside these bubbles?
    b.   Is the boiling of water a chemical or physical change? Explain

11. Dalton assumed that all atoms of the same element were identical in all their properties. Explain why this assumption is not valid.

12. Why do we call $Ba(NO_3)_2$ barium nitrate, but we call $Fe(NO_3)_2$ iron(II) nitrate?

13. Calculate the mass of O_2 produced if 3.450 g potassium chlorate is completely decomposed by heating in presence of a catalyst (Manganese dioxide).

14. Write the formula of the following compounds?
    a. Calcium sulfate   b. Ammonium phosphate   c. Lithium nitrite

    d. Potassium perchlorate   e. Barium oxide   f. Zinc sulfide

    g. Sodium perbromate   i. Calcium iodide   j. Aluminum carbonate

15. Convert **6.75 atm** to: (Using **dimensional analysis** method)

a.torr Hg   b. kilo pascals   c.   mm of Hg

16. Define the words: **atomic number, atomic mass, mass number, molecular formula, structural formula, empirical formula, isotopes, cation, anion, metalloid, and allotrope**.

17. Determine **number of protons and neutrons** in each of the following.

    a. $^{39}_{19}$ K   b. $^{23}_{11}$Na.   c. $^{208}_{82}$Pb   d. $^{33}_{15}$P

18. White gold is an alloy that typically contains 45.0% by mass gold and the remainder is platinum. If **154 g** of gold are available, how many grams of platinum are required to combine with the gold to form this alloy?

19. What is the empirical formula of a compound that contains 53.73% Fe and 46.27% of S ?

20. Determine the number of molecules present in 4.56 mol of nitrogen (N_2).

21. List the following as diatomic molecule, molecular compound, ionic compound, or element.
    a. F_2 b. Cl_2 c. C   d. NaCl   e. KF
    f. CO_2 g. H_2 h. Ag   i. Rust (Fe_2O_3)   j. MgO
    k. O_2 l. I_2 m.CO   n. K_2CO_3

22. State the contribution of the following chemist in one line.
    a. Democritus   b. Mendeleev   c. Henry Becquerel   d. Roentgen   e. J.J Thompson

     f.Faraday   g. Chadwick   h. Millikan   i. Proust   j. Cavendish k. Madam Curie

23. What is the difference between   a. Chlorine and Chloride?   b. Sodium atom and sodium ion?

24. How many grams of methane (CH_4) are present in 5.6 moles of methane gas?

25. Calculate the **mass in grams** of each of the following:
    a. 6.02×10^{23} atoms of Mg.
    b. 3.01×10^{23} Formula units of $CaCl_2$.
    c. 12.4×10^{15} atoms of neon.

26. In an experiment, a student gently heated a hydrated copper compound to remove the water of hydration. The following data was recorded:
    1. Mass of crucible, cover, and contents before heating 23.4 g.
    2. mass of empty crucible and cover   18.82 g.
    3. mass of crucible, cover, and contents after heating to constant mass   20.94 g.
    Calculate the experimental percent of water in the compound.

27. How do you distinguish:
    a. An element from a compound.
    b. An element from a mixture.
    c. A true solution from a heterogeneous mixture.
    d. Distillation from filtration.
    e. Chromatography from crystallization

28. An **extensive property** is one that depends on the amount of the sample. Which of the following properties are extensive?
    a. volume   b. density   c. temperature   d. energy   e. melting point.   F. pressure

29. A hydrated compound has an analysis of 18.29% Ca, 32.37% Cl, and 49.34% water. What is its formula?

30. Define Arrhenius acid, base and salt; Bronsted-Lowry acid and base; and Lewis acid and base. Give some examples of each.

31. What mass of copper is required to replace silver from 4.00g of silver nitrate dissolved in water? Check to see if the equation is balanced first.
    $$Cu(s) + AgNO_3 \rightarrow Cu(NO_3)_2 + Ag.$$

32. Write the chemical formulas for the following compounds:
    a. Zinc(II) Nitrate   b. Iron(III) Phosphate   c. Nickel (II) Fluoride

33. Define   a. Law of conservation of mass.   b. Law of multiple proportion.

34. Strontium consists of four isotopes with masses and their percent abundance of 83.9134 amu (0.5%), 85.9094 amu (9.9%) , 86.9089 amu (7.0 %) , and 87.9056 amu (82.6 %). Calculate the atomic mass of Sr.

35. Nitrogen has two isotopes, N-14 and N-15, with atomic masses of 14.00031 amu and 15.001 amu, respectively. What is the percent abundance of N-15?

36. Mercury has an atomic mass of 200.59 amu. Calculate the:
    a. Mass of 3.0×10^{10} atoms.
    b. Number of atoms in one nanogram of Mercury.

37. Calculate the molar masses (g/ mol) of
    a. Ammonia (NH_3)   b. Baking soda ($NaHCO_{3)}$)   c. Osmium Metal (Os)

38. Convert the following to moles
    a. 3.86 grams of Carbon dioxide.
    b. 6.0×10^5 g of Hydrazine (N_2H_4), a rocket propellant.

39. The molecular formula of morphine, a pain-killing narcotic, is $C_{17}H_{19}NO_3$.
    a. What is the molar mass?
    b. What fraction of atoms in morphine is accounted for by carbon?
    c. Which element contributes least to the molar mass?

40. The hormone, thyroxine is secreted by the thyroid gland, and has the formula: $C_{15}H_{17}NO_4I_4$. How many milligrams of Iodine can be extracted from 15.0 Grams of thyroxine?

41. Determine the **formula weight** for the following:

    a. N_2O_5 b. $CuSO_4$ c. $Ca(HCO_3)_2$ d. $CaSO_4 \cdot 2H_2O$

42. Calculate the percentage by mass of each element in the following compounds:
    a. SO_3 b. CH_3COOCH_3 c. Ammonium Nitrate.

43. Determine the empirical formula of the compounds with the following compositions by mass:
    a. 10. 4 % C, 27. 8% S , 61. 7 % Cl
    b. 21.7 % C, 9.6 % O, and 68.7 % F

44. Arsenic reacts with chlorine to form a chloride. If 1.587 g of arsenic reacts with 3.755 g of chlorine, what is the simplest formula of the chloride?

45. Vanillin, a flavoring agent, is made up of carbon, hydrogen, and Oxygen atoms. When a sample of Vanillin weighing 2.500g burns in Oxygen, 5.79 g of carbon dioxide and 1.18 g of water are obtained. What is the empirical formula of Vanillin?

46. Washing soda is a hydrate of sodium carbonate. Its formula is $Na_2CO_3 \cdot xH_2O$. A 2.714 g Sample of washing soda is heated until a constant mass of 1.006 g of Na_2CO_3 is reached. What is x?

47. What is the molecular formula of each of the following compounds?

    a. empirical formula CH_2 , molar mass =84g/mol.

    b. Empirical formula NH_2Cl, Molar mass = 51.5 g/ Mol

48. Determine the empirical and molecular formula of each of the following substances:
    a. Ibufuren, a headache remedy contains 75.6 % C, 8.80 % H , and 15.5 % O by mass and has a molar mass about 206 g/mol.

    b. Epinerphine(adrenaline) a hormone secreted into the bloodstream in times of danger or stress contains 59% C, 7.1% H, 26.2% O, and 7.7% N by mass, its MW is about 180 amu.

49. Write a **balanced equation** for the following:
    a. Reaction of boron trifluoride gas with water to give liquid hydrogen fluoride and solid boric acid,(H_3BO_3).

    b. Reaction of magnesium oxide with iron to form iron (III) oxide and magnesium.

    c. The decomposition of dinitrogen oxide gas to its elements.

d.The reaction of Calcium Carbide solid with water to form calcium hydroxide and acetylene (C_2H_2) gas.

e.The reaction of solid calcium cyan amide ($CaCN_2$) with water to from calcium carbonate and ammonia gas.

f.Ethane burns in air (Oxygen).

g.Hydrogen reacts with oxygen to from Water.

h.Nitrogen gas reacts with Hydrogen to form Ammonia.

j.Hydrogen reacts with Iodine gas to form Hydrogen Iodide.

k. Sodium reacts with Iodine gas to form Sodium Iodide.

l.Sodium Oxide reacts with water to form sodium hydroxide and hydrogen.

m.Carbon dioxide combines with water to form carbonic acid.

n.Magnesium and nitrogen gas combine to form magnesium nitride.

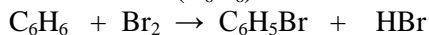o.Conc. hydrochloric acid reacts with conc. sodium hydroxide to form sodium chloride and water.

50. DEFINE limiting reagent, theoretical yield , and actual yield?

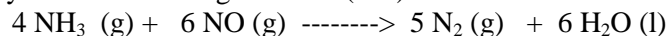51. Sodium hydroxide reacts with carbondioxide as follows:

$2NaOH(s) + CO_2 (g) \rightarrow Na_2CO_3 (s) + H_2O(l)$
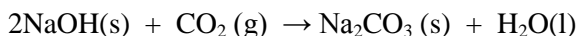
Which reagent is the limiting reactant when 1.85 mol of sodium hydroxide and 1.00 mol carbondixide are allowed to react? How many moles of sodium carbonate can be produced? How many moles of the excess reactant remain after the completion of the reaction?

52. WHEN benzene (C_6H_6) reacts with bromine (Br_2) bromobenzene(C_6H_5Br) is obtained:
    $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$
a.What is the theoretical yield of bromobenzene in this reaction when 30.0g of benzene reacts with 65.0 g of bromine?
b. If the actual yield of bromobenzene was 56.7 g what was the percentage yield?

53. One way to remove Nitrogen Oxide (NO) from smokestack emissions is to react it with ammonia:
           $4 NH_3 (g) + 6 NO (g) \text{ --------> } 5 N_2 (g) + 6 H_2O (l)$
                 Fill in the blanks below:

              a. 12.3 mol of NO reacts with _____ mol of ammonia.
              b. 5.87 mol NO yields _____ mol nitrogen.

54. Chlorine and Fluorine react to form gaseous chlorine trifluoride. You start with 1.75 mol of chlorine and 3.68 mol of fluorine.
                    a.Write the balanced equation for the reaction.
                    b.What is the limiting reactant?

55. **Define solubility. Prepare a list of solubility rules for ionic compounds in water. (search some online resources) (IMPORTANT)**

56. Name the following: a. CO_2 b. P_4S_{10} c. NI_3 d. PCl_5 e. SF_6 f. CH_4 g. C_2H_6

57. Which of the following statements are always true? Never true? Not always true?
   a. A compound with the molecular formula C_6H_6 has the same simplest formula.
   b. The mass percent of copper in CuO is less than in Cu_2O.
   c. The limiting reactant is the one present in the smallest number of grams.
   d. Since $C_3H_6O_3$ and $C_6H_{12}O_6$ reduce to the same formula, they represent the same compound.

58. Define strong electrolyte, weak electrolyte, precipitation reactions and solubility?

59. What is an **Activity series** of metal? How does it help us in studying properties of elements?

60. A volatile liquid (one that evaporates) is put into a jar and the Jar is then sealed. Does the mass of the sealed jar and its contents change upon the vaporization of the liquid?

61. Identify each of the following as being most like an **observation, a law, or a theory**.
   a.   All coastal areas experience two high tides and two low tides each day.
   b.   The tides in Earth's oceans are caused mainly by the gravitational attraction of the moon.
   c.   Yesterday, high tide in San Francisco Bay occurred at 2.43 a.m. and 3.07 P.m.
   d.   Tides are higher at the full moon and ne moon than at other times of the month.

62. Define the terms: Exothermic, endothermic reactions.

63. How much heat is required to raise the temperature of 100 grams of water from 25^0C to 82^0C?

64. A piece of unknown metal with mass 14.9 g is heated to 100^0C and dropped into 75.0 g of water at 20^0C. The final temperature of the system is 28 degree Celsius. What is the specific heat of the metal?

65. What is a solute and solvent? Define Molarity and Molality.

66. Calculate the molarity of a solution that contains 0.0345 mol NH_4Cl in exactly 400 ml of solution?

67. Calculate the molarity of a solution that contains 20.0grams of sodium hydroxide in 200ml?

68. How many grams of solute are present in 50.0 ml of 0.360 M sodium chloride?

69. What volume of 0.100 M HCl solution is needed to neutralize 50.0 ml of 0.350 M KOH?

70. Differentiate between what happens when the following are dissolved in water.

   a.   Polar solute vs non polar solute.
   b.   KF   vs CO_2
   c.   RbCl   vs   AgCl

The following ions and the rules of naming acids must be memorized.

Common monoatomic ions

Ion Name	Ion Symbol	Ion Name	Ion Symbol
Sodium		Nitrogen	
Potassium		Arsenic	
Cesium		Bismuth	
Beryllium		Oxygen	
Calcium		Fluorine	
Strontium		Chlorine	
Barium		Bromine	
Gallium		Iodine	
Aluminum			

Common ions of transition elements

Ion Name	Ion Symbol
Chromium(III)	
Manganese(II)	
Iron(II) or Ferrous	
Iron(III) or Ferric	
Cobalt(II)	
Nickel(II) or nickel	
Copper(II) or Cupric	
Zinc	
Silver	
Cadmium	
Mercury(II) or mercuric	

Common Polyatomic Ions

Name	Formula	Name	Formula
a) Acetate		b) Ammonium	
c) Carbonate		d) Chlorate	
e) Chlorite		f) Chromate	
g) Cyanide		h) Dichromate	
i) Dihydrogen Phosphate		j) Dihydrogen Phosphate	
k) Hydrogen Carbonate		l) Hydrogen Sulfate	
m) Hydrogen Sulfite		n) Hypochlorite	
o) Hydroxide		p) Nitrate	
q) Nitrite		r) Oxalate	
s) Perchlorate		t) Permanganate	
u) Perioxide		v) Phosphate	
w) Sulfate		x) Sulfite	
y) Thiosulfate			

Common Acids	Formula	Common Acids	Formula
Hydrochloric Acid		Phosphoric acid	
Perchloric acid		Sulfurous Acid	
Carbonic acid		Sulfuric Acid	
Nitrous acid		Nitric Acid	
Chloric Acid		Hypochlorous Acid	
Chlorous Acid			