AP Chemistry Summer Assignment #6

1. What is the molecular mass of crotonaldehyde C_4H_6O?

2. A substance contains 23.0 g sodium, 27.0 g aluminum, and 114 g fluorine. How many grams of sodium are there in a 120.-g sample of the substance?

3. $NaHCO_3$ is the active ingredient in baking soda. How many grams of oxygen are in 0.35 g of $NaHCO_3$?

4. A sample of copper weighing 6.93 g contains how many moles of copper atoms?

5. Roundup, a herbicide manufactured by Monsanto, has the formula $C_3H_8NO_5P$

How many moles of molecules are there in a 500.-g sample of Roundup?

6. What is the molecular weight of ammonium chloride?

7. What is the percent by mass of bromine in ammonium perbromate? (The perbromate ion is BrO_4-.)

8. A chloride of rhenium contains 63.6% rhenium. What is the formula of this compound?

9. The mass percent of carbon in a compound containing only oxygen and carbon is 27.29%. Calculate the empirical formula.

10. A 2.00-g sample of an oxide of bromine is converted to 2.936g of AgBr. Calculate the empirical formula of the oxide. (Mol. mass. for AgBr = 187.78)

11. Phenol is a compound which contains 76.57% carbon, 6.43% hydrogen, and 17.0% oxygen. The empirical formula of phenol is __

12. The empirical formula of a group of compounds is CHCl. Lindane, a powerful insecticide, is a member of this group. The molecular weight of lindane is 290.8. How many atoms of carbon does a molecule of lindane contain?

13. What is the empirical formula of an oxide of nitrogen which contains 36.8% nitrogen?

14. An oxide of iron contains 69.9% iron.What percent by mass of oxygen does this compound contain?

15. An oxide of iron has the formula Fe_3O_4. What mass percent of iron does it contain?

16. The empirical formula of styrene is CH; its formula weight is 104.1. What is the molecular formula of styrene?

17. What mass of styrene (molecular mass 104.1) will contain 4.5×10^{20} molecules of styrene?

18. Adipic acid contains 49.32% C, 43.84% O and 6.85% H by mass. What is the empirical formula?

19. Phosphorus has the molecular formula P4 and sulfur has the molecular formula S_8. How many grams of phosphorus contain the same number of molecules as 6.41 g of sulfur?

20. The molecular mass of an insecticide, dibromoethane, is 187.9. Its molecular formula is $C_2H_4Br_2$. What percent by mass of bromine does dibromoethane contain?

21. The molecular mass of an insecticide, dibromoethane, is 187.9. Its molecular formula is $C_2H_4Br_2$. How many atoms of carbon are in a sample of dibromoethane weighing 1.879 g?

22. Ammonium carbonate contains what percent nitrogen by mass?

23. A given sample of a xenon fluoride contains molecules of a single type XeFn, where n is some whole number. Given that 9.03×10^{20} molecules of XeFn weigh 0.311 g, calculate n.

24. Vitamin C contains the elements C, H and O It is known to contain 40.9% C and 4.58% H by mass. The molecular weight of Vitamin C has been found to be about 180. The molecular formula for Vitamin C is:

25. The percent calcium (by mass) in calcium fluoride is:

26. How many moles of S_8 molecules are there in 80.3 g of sulfur?

27. Consider the element indium, atomic number 49, atomic weight 114.8. The nucleus of an atom of indium- 112 will contain:

28. The Claus reactions, shown below, are used to generate elemental sulfur from hydrogen sulfide.

$2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$
$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$

How much sulfur (in grams) is produced from 48.0 grams of O_2?

29. Potassium forms an oxide containing 1 oxygen atom for every 2 atoms of potassium. What is the coefficient of oxygen in the balanced equation for the reaction of potassium with oxygen to form this oxide?

30. The balanced equation for the neutralization of phosphoric acid with calcium hydroxide shows _____molecules of water produced. Calcium phosphate is the other product.

31. A 6.32-g sample of potassium chlorate was decomposed according to the following equation: $2KC1O_3 \rightarrow 2KCl + 3O_2$. How many moles of oxygen are formed?

32. A 15-g sample of lithium is reacted with 15 g of fluorine to form lithium fluoride: $2Li + F_2 \rightarrow 2LiF$

After the reaction is complete, what will be present?

33. How many moles of oxygen are necessary to burn 2.0 moles of benzene, C_6H_6 to carbon dioxide and water?

34. How many molecules of water are required to balance the equation for the reaction of hydrochloric acid with calcium hydroxide? Calcium chloride is the other product.

35. How many molecules of oxygen are required in the balanced equation showing the complete combustion of propane, C_3H_8, to produce CO_2 and H_2O?

36. What is the subscript of aluminum in the formula of aluminum phosphate?

37. Indium reacts with chlorine to form $InCl_3$. In the balanced equation for this reaction, the coefficient of the indium trichloride is:

38. In the simplest balanced equation with whole number coefficients for the reaction of hydrogen with oxygen to form water, what is the coefficient of oxygen?

39. When the following equation is balanced

$A1_2(CO_3)_3 + HCl \text{ ---> } AlCl_3 + CO_2 + H_2O$

the sum of the coefficients is:

40. Give (in order) the correct coefficients to balance the following reaction:

$H_2SnC1_6 + H_2S \text{ ---> } SnS_2 + HCl$

41. How many grams of $Ca(NO_3)_2$ can be produced by reacting excess $HNO_3$with 7.40 g of $Ca(OH)_2$?

42. What would be the g Al/mole S ratio for the product of a reaction between aluminum and sulfur?

43. Consider the fermentation reaction of glucose:

yeast
$C_6H_{12}O_6 \text{ -----> } 2C_2H_5OH + 2CO_2$

A 1.00-mole sample of $C_6H_{12}O_6$ was placed in a vat with 100g of yeast. If 46 grams of C_2H_5OH was obtained, what was the percent yield of C_2H_5OH?

44. A 5.95-g sample of $AgNO_3$ is reacted with $BaCl_2$ according to the equation

$2AgNO_3(aq) + BaCl_2(aq) \text{ ---> } 2AgCl(s) + Ba(NO_3)_2(aq)$

to give 4.00 g of AgCl. What is the percent yield of AgCl?

45. The molecular mass of salicylic acid is 138 and that of aspirin is 180. If 6.9 g of salicylic acid reacts with an excess of the other reagents to give 6.0 g of aspirin, what is the percent yield? (Assume a 1:1 reaction between salicylic acid and aspirin.)

46. Baking powder, a mixture of cream of tartar (KHC4H4O6, molecular weight 188) and baking soda $NaHCO_3$, molecular mass = 84.0), undergo the following reaction at baking temperatures:

$KHC_4H_4O_6 + NaHCO_3$---> $KNaC_4H_4O_6 + H_2O + CO_2$

(The CO_2 makes the cake "rise.") A recipe calls for two level teaspoons (a total of 8.0 g) of cream of tartar. How much baking soda must be added for both materials to react completely?

47. How many grams of H_2O will be formed when 32.0 g H_2 is mixed with 32.0 g O2 and allowed to react to form water?

48. The reaction of 11.9 g of $CHCl_3$ with excess chlorine produced 12.6 g of CCl_4, carbon tetrachioride: $2CHCl_3 + 2C1_2$ ---> $2CC1_4 + 2HC1$

What is the percent yield?

49. Sulfuric acid may be produced by the following process:

$4FeS_2 + 11O_2$ ---> $2Fe_2O_3 + 8SO_2$
$2SO_2 + O_2$ ---> $2SO_3$
$SO_3 + H_2O$ ---> H_2SO_4

How many moles of H_2SO_4 will be produced from 5.00 moles of FeS_2?

50. Reaction of methane with oxygen really proceeds in two steps:

$CH_4 + (3/2)O_2$ ---> $CO + 2H_2O$
$CO + (1/2)O_2$ ---> CO_2

A sample of CH_4 is burned in an excess of O_2 to give 2.2 moles of H_2O. How many moles of CH_4 were in the original sample?

51. Phosphoric acid can be prepared by reaction of sulfuric acid with "phosphate rock" according to the equation

$Ca_3(PO_4)_2 + 3H_2SO_4$—---> $3CaSO_4 + 2H_3PO_4$

What is the molecular weight of $Ca_3(PO_4)_2$?

52. Phosphoric acid can be prepared by reaction of sulfuric acid with "phosphate rock" according to the equation:

$Ca_3(PO_4)_2 + 3H_2SO_4$ ---> $3CaSO_4 + 2H_3PO_4$

How many oxygen atoms are there in 1.55ng of $Ca_3(PO_4)_2$?

53. Phosphoric acid can be prepared by reaction of sulfuric acid with "phosphate rock" according to the equation:

$Ca_3(PO_4)_2$+ $3H_2SO_4$ ---> $3CaSO_4 + 2H_3PO_4$

Suppose the reaction is carried out starting with 103 g of Ca3(PO4)2 and 75.0 g of H2SO4. Which substance is the limiting reactant?

54. Phosphoric acid can be prepared by reaction of sulfuric acid with “phosphate rock” according to the equation:

$Ca_3PO_4)_2 + 3H_2SO_4 \text{ ---> } 3CaSO_4 + 2H_3PO_4$

Suppose the reaction is carried out starting with 103 g of Ca3(PO4)2 and 75.0 g of H2SO4. How much phosphoric acid will be produced?

55. Iron is produced from its ore by the reactions:

$2C(s) + O_2(g) \text{ ---> } 2CO(g)$
$Fe_2O_3(s) + 3CO(g) \text{ ---> } 2Fe(s) + 3CO_2(g)$

How many moles of $O_2(g)$ are needed to produce 1 mole of Fe(s)?

56. When 20.0 g C_2H_6 and 60.0 g O_2 react to form CO_2 and H_2O, how many grams of water are formed?

57. The chemical process of rusting is described by the following equation:

$4Fe(s) + 3O_2(g) \text{ ---> } 2\ Fe_2O_3(S)$

The maximum amount of rust that can be produced from 56 g Fe and 32 g O2 is:

58. When the equation $C_4H_{10} + O_2 \text{ ---> } CO_2 + H_2O$ is balanced with the smallest set of integers, the sum of the coefficients is:

59. The refining of aluminum from bauxite ore (which contains 50.% Al_2O_3 by mass) proceeds by the overall reaction $2A1_2O_3 + 3C \text{ ---> } 4A1 + 3CO_2$. How much bauxite ore is required to give the 5.0×10^{13} g of aluminum produced each year in the United States? (Assume 100% conversion.)

60. Consider the following reaction:

$CH_4(g) + 4C1_2\ (g) \text{ ---> } CC1_4(g) + 4HCl(g)$

What mass of CCl_4 is formed by the reaction of 8.00 g of methane with an excess of chlorine?

61. Consider the following reaction:

$CH_4\ (g) + 4Cl_2 \text{ ---> } CC1_4\ (g) + 4HCl(g)$

What mass of CCl_4 will be formed if 1.20 moles of methane react with 1.60 moles of chlorine?

62. Sugar has an empirical formula of CH_2O and a molecular mass of 180.2 g/mole. If one teaspoon of sugar weighs 3.50 grams, how many moles and molecules of sugar are present?

63. A 2.00 g sample of a compound composed of C and H is burned, forming 6.62 g of CO_2 and 1.69 g of H_2O. What is the empirical formula of the compound?

64. Naturally occurring boron exists in two isotopic forms: the more common isotope is 11 B (atomic mass = 11.01 amu) which is 80.00% abundant. Given that the average atomic mass of boron is 10.81, what is the atomic mass of the second isotope?

65. One commercial system removes SO_2 emissions from smoke at 95.000 by the following set of balanced reactions:

SO_2 (g) + Cl_2 ---> SO_2Cl_2
SO_2 $C1_2$ + $2H_2O$ ---> H_2SO_4 + 2HCl
H_2 SO_4 + $Ca(OH)_2$ ---->$CaSO_4$(s) + $2H_2O$

Assuming the process is 95.0% efficient, how many grams of $CaSO_4$ may be produced from 1.00 x $l0^2$ grams of SO_2? (molar mass of SO_2 = 64.1 g/mole; molar mass of $CaSO_4$= 136 g/mole)

66. A reaction occurs between sodium carbonate and hydrochloric acid producing sodium chloride, carbon dioxide, and water. The correct set of coefficients, respectively, for the balanced reaction is:

67. Iron is biologically important in the transport of oxygen by red blood cells from the lungs to the various organs of the body. In the blood of an adult human, there are approximately 2.60 x 1013 red blood cells with a total of 2.90 g of iron. On the average, how many iron atoms are present in each red blood cell? (atomic mass. (Fe) = 55.85 amu)

68. The following two reactions are important in the blast furnace production of iron metal from iron ore (Fe_2O_3).

2C(s)+ O_2(g) ---> 2CO(g)
Fe_2O_3 + 3CO(g) ---> 2Fe + $3CO_2$(g)

Using these balanced reactions, how many moles of O2 are required for the production of 5.00 kg of Fe (atomic mass. = 55.85)?

69. SO_2 is produced when products containing sulfur (Illinois coal) are burned. SO_2 released into the atmosphere reacts to form sulfuric acid according to the equation:

$2SO_2(g) + O_2(g) + 2H_2O(1)$---> $2H_2SO_4(l)$

How many grams of H_2SO_4 (molar mass=98.1 g/mol) can be produced if 2.00 mol O_2 and 3.00 mol SO_2 are combined with excess water?

70. Gallium consists of two isotopes of masses 68.95 amu and 70.95 amu with abundance of 60.16% and 39.84%, respectively. What is the average atomic weight of gallium?

71. What is the coefficient for O2 when the equation below is balanced?

__C_2H_6 + __O_2 ---> _CO_2 + __H_2O

72. When the following equation is balanced, what is the sum of the coefficients?

__$Al_2(SO_4)_3$ + __$Ca(OH)_2$ ----> __$Al(OH)_3$ + __$CaSO_4$