Chemistry 2H Summer Work

Before the 1st day of class:

1. Work the following problems on separate sheets of paper-Show all of your work and circle your final answer. All of these problems may be done with a Periodic Table and a calculator.

2. The problems are due the first day of class and will count as your first grade.

3. Approximately 50% of the first test will consist of writing names & formulas. You will need to know both monatomic & polyatomic ions. The charge of many of the monatomic ions can be found from the periodic table: elements in the 1st column are 1^+, the second column 2^+; similarly, those in the 2nd to last column are 1^-, the 3rd to last column, 2^-, etc. The transition elements are variable, but you can often work backwards from the compound to determine which particular species is being used.

Have a great summer!
Peace, Love, Chemistry

Dr. K

1.Put the following prefixes in order, from smallest to largest: nano, Mega, tera, deci, kilo, micro, milli, giga, pico.

2. A student weighed 15 pennies on a balance and recorded the following masses:

3.078, 2.107, 2.546, 3.055, 3.121
3.050, 3.060, 2.518, 3.073, 3.066
3.052, 3.080, 3.102, 2.476, 3.128

a.Calculate the mean mass.
b. What might cause the difference in weights?

4. What is the difference between accuracy and precision?

5. What is the difference between a physical change and a chemical change?

6. Why must measurements always be written with a unit?

7. Convert 8.2 mg/mL to μg/L

8. Convert 230 km^3 to m^3

9. How many significant figures are there in each of the following values?
a. 6.07×10^{-13}
b. 0.003840
c. 17.00
d. 8×10^6
e. 463.8052

10. How many significant figures are there in each of the following values?
a. 1406.20
b. 0.0007
c. 1600.0
d. 0.0261140
e. 1.250×10^{-3}

11. Which value has more significant figures, 7.63×10^{-11} or 0.00076?

12. Use scientific notation to express the number 37,100,000 with:
a. one sig fig

b. two sig figs
c. three sig figs
d. four sig figs

13. Perform the indicated calculations on the following measured values, giving the final answer with the correct number of significant figures.
a. 16.81 + 3.2257
b. 324.6 x 815.991
c. $(3.8 \times 10^{-12} + 4 \times 10^{-13})/(4 \times 10^{12} + 6.3 \times 10^{13})$
d. $3.14159 \times 68/(5.18 \times 10^{-11} - 6 \times 10^{-4})$
14. A runner can run a 5.0 kilometer race in a time of 21 minutes and 22 seconds.
a. What is the runner's speed in miles per hour?
b. How long, on the average, did it take for the runner to run one mile?

15. A student made the 27.0 kilometer drive to school in 16 minutes.
a. How many miles did the student drive?
b. If the speed limit is 55 mph, was the student speeding? How fast was the student driving?

16. Which of the following is greater,
a. 35 kg or 3500 grams?
b. 6×10^4 mL or 6×10^3 L?

17. Which is the higher temperature, 42°C or 92°F?

18. Perform the following temperature conversions:
a. 300 K to °F
b. 300 °F to K
c. -40°F to °C
d. -100°C to K
e. 1555 K to °C
f. 0.0 K to °F

19. Perform the following temperature conversions:
a. 16°C to °F
b. 305K to °F
c. 0.0°F to °C
d. 150°F to K
e. -45°C to K
f. 920 K to °C

20. The density of an object is 1.63 g/mL. Its volume is 0.27 L. What is the mass of the object?

21. Which of the following is less:
a. 8.7 g/mL or 6.1 $\mu g/\mu L$?
b. 4×10^{-2} kg/cm^3 or 4×10^{-1} mg/cm^3?

22. By experiment it has been found that 2.18 g of zinc metal combines with oxygen. How many grams of sulfur and grams of oxygen are present in a second sample of H_2SO_4 containing 7.27 g of hydrogen?

23. How many protons & neutrons are in each of the following elements?
a. ^{227}Ac
b. ^{70}Ga
c. ^{11}B
d. ^{251}Cf
e. ^{239}Pu
f. ^{64}Cu

24. How many protons, neutrons, & electrons are in each of the following elements?
a. $^{56}Fe^{3+}$
b. $^{40}Ca^{2+}$
c. $^{19}F^{-}$
d. $^{31}P^{3-}$
e. $^{127}I^{-}$
f. $^{127}I^{7+}$

25. Given their position in the periodic table, what is the most likely oxidation state that each element will have when forming an ion?
a. Cs
b. N
c. Br
d. K
e. Al
f. S

26. Would you expect the following atoms to gain or lose electrons when forming an ion? If so, how many would be gained or lost?
a. Be

b. Cl
c. Al
d. O
e. F
f. Li
g. P

27. Predict the formula and state the name of the compound likely to be formed from the following pairs of elements:

a.sodium and fluorine
b. aluminum and oxygen

28. Predict the formula and state the name of the compound likely to be formed from the following substances:

a.calcium and phosphate ion
b. potassium and nitrate ion

29. Name each of the following compounds:

a.PbI_2
b. NH_4Cl
c. Fe_2O_3
d. LiH
e. CsCl
f. OsO_4
g. $Cr(OH)_3$
h. $NaC_2H_3O_2$
i. $K_2Cr_2O_7$
j. Na_2SO_4
k. KH_2PO_4

30. Name each of the following compounds:
a.$MgSO_4$
b. N_2O_3
c. Ce_2O_3
d. $KMnO_4$
e. NiO
f.$BaSO_4$

g.$Fe(IO_4)_3$
h. SO_3
i. $KClO_4$

31. Name each of the following compounds:
a. NI_3
b. PCl_5
c. CO
d. P_4O_{10}
e. N_2O_4
f. NH_3

32. Name each of the following compounds:
a.P_4O_6
b. KOH
c. N_2
d. $AgNO_3$
e. BF_3
f. AgCl
g. $KHCO_3$

33. Name each of the following compounds:
a. HIO_3
b. HBr
c. HNO_2
d. HCN
e. $NaNO_2$
f. K_2SO_3
g. $NaHSO_3$

34. Write formulas for each of the following compounds:
a. sodium cyanide
b. tin (II) fluoride
c. sodium hydrogen sulfate
d. lead (II) nitrate
e. iron (III) oxide
f. calcium phosphate
g. sodium bromate

35. Write formulas for each of the following compounds:

a. sodium sulfate
b. manganese dioxide
c. potassium chlorate
d. potassium hypochlorite
e. lithium aluminum hydride
f. barium chloride
g. magnesium oxide
h. copper (I) oxide

36. Write formulas for each of the following compounds:
a. potassium carbonate
b. magnesium hydroxide
c. dintrogen tetroxide
d. iron (III) chloride
e. tin (IV) oxide
f. barium sulfate
g. rubidium nitrate
h. potassium chlorate
i. carbon tetrachloride
j. sodium iodate
k. potassium permanganate
l. sulfurous acid
m. potassium hydrogen phosphate
n. ammonium acetate
o. ammonium dichromate
p. hydrobromic acid

37. How many grams of zinc are in 1.16×10^{22} atoms of zinc?

38. Calculate the molar masses of each of the following:
a. Copper (II) sulfate
b. Ammonium hydroxide
c. $C_{10}H_{16}O$
d. $Zr(SeO_3)_2$
e. $Ca_2Fe(CN)_6.12\ H_2O$
f. $Cr_4(P_2O_7)_3$

39. What is the mass of 4.28×10^{22} molecules of water?

40. How many sodium ions are present in the following?

a. 2 moles of sodium phosphate
b. 5.8 grams of sodium chloride
c. a mixture containing 14.2 grams of sodium sulfate and 2.9 grams of sodium chloride

41. How many potassium ions are present in the following?
a. 3 moles of potassium chloride
b. 6.2 grams of potassium nitrate
c. a mixture containing 12.6 grams of potassium phosphate and 5.4 grams of potassium chloride

42. What is the weight in grams of:
a. 0.4 moles of CH_4
b. 11 moles of SO_4^{2-}
c. 5 moles of $Mg(OH)_2$?

43. A sample of calcium chloride has a mass of 23.8 g. How many moles of calcium chloride is this?

44. A compound is found, by mass spectral analysis, to contain the following percentages of elements by mass: C = 49.67%, Cl = 48.92%, H = 1.39%

45. Determine the empirical formula of a compound that contains the following percentages of elements by mass: Mo = 43.95%, O = 7.33%, Cl = 48.72%

46. A molecule with a molecular weight of approximately 110 g/mole is analyzed. The results show that it contains 10.05% of carbon, 0.84% of hydrogen, and 89.10% of chloride. Calculate the molecular formula of this compound.

47. Using the data provided, calculate the empirical formula for the compounds indicated:
a. an oxide of nitrogen, a sample of which contains 6.35 g of nitrogen and 3.65 g of oxygen
b. an oxide of copper, one gram of which contains 0.7989 g of copper
c. a compound of potassium, chloride, and oxygen, containing K = 31.97%, O = 39.34%

48. How many grams of water vapor can be generated from the combustion of 18.74 g of ethanol? $C_2H_6O(g) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$ (unbalanced)

49. How many grams of sodium hydroxide are required to form 51.63 g of lead hydroxide? $Pb(NO_3)_2$ (aq) + NaOH(aq) -> $Pb(OH)_2$(s) + $NaNO_3$(aq) (unbalanced)

50. How many grams of potassium iodide are necessary to completely react with 20.61 g of mercury (II) chloride?
$HgCl_2$ (aq) + KI (aq) -> HgI_2 (aq) + KCl (aq) (unbalanced)

51. A reaction combines 133.484 g of lead (II) nitrate with 45.010 g of sodium hydroxide (see problem 49 for equation)

a.How much lead (II) hydroxide is formed?
b. Which reactant is limiting? Which is in excess?
c. How much of the excess reactant is left over?
d. If the actual yield of lead (II) hydroxide were 80.02 g, what was the percent yield?

52. A reaction combines 64.81 g of silver nitrate with 92.67 g of potassium bromide.

$AgNO_3$ (aq) + KBr (aq) -> AgBr (s) + KNO_3 (aq)

a.How much silver bromide is formed?
b. Which reactant is limiting? Which is in excess?
c. How much of the excess reactant is left over?
d. If the actual yield of silver bromide were 14.77 g, what was the percent yield?

53. A reaction proceeds between 94.6 g of KClO3 and 65.3 g of P4

$KClO_3$ (s) + P_4 (s) -> P_4O_{10} (s) + KCl (s) (unbalanced)

a.How much potassium chloride is formed?
b. Which reactant is limiting? Which is in excess?
c. How much of the excess reactant is left over?
d. If the actual yield of potassium chloride were 21.0 g, what was the percent yield?

54. Calculate the molarity of each of the following solutions:
a. 49.73 g H_2SO_4 in enough water to make 500 mL of solution
b. 4.793 g $RuCl_3$ in enough water to make 1.00 L of solution
c. 5.0535 $FeCl_3$ in enough water to make 250 mL of solution
d. 27.74 g $C_{12}H_{22}O_{11}$ in enough water to make 750 mL of solution
e. 218.7 g HCl in enough water to make 500 mL of solution

55. Describe how you would prepare the following solutions:
a. 500 mL of 1.0 M H_2SO_4 from 17.8 M H_2SO_4

b. 1.5 L of 0.25 M $KMnO_4$ from 1.0 M stock solution
c. 1.0 L of 0.15 M $KBrO_3$ from solid $KBrO_3$
d. 100 mL of 0.01 M $AgNO_3$ from 0.5 M stock solution

56. A stock solution of sodium hydroxide is prepared by dissolving 120.0 g of NaOH in 500.0 mL of water. What is the molarity of the solution?

57. Name the following covalent compounds:
a. SiF_4
b. N_2S_3
c. HBr
d. Br_2

58. Write the formulas for the following covalent compounds:
a. diboron hexahydride
b. nitrogen tribromide
c. sulfur hexachloride
d. diphosphorus pentoxide

59. List three differences between ionic and covalent compounds

60. Explain why ionic compounds are formed when a metal bonds with a nonmetal but covalent compounds are formed when two nonmetals bond.

61. What are the chemical formulas of the following molecules?
a. carbon disulfide
b. boron trifluoride
c. carbon tetrafluoride

62. Name the following chemical compounds:
a. NaBr
b. P_2O_5
c. $Ti(SO_4)_2$
d. $FePO_4$
e. K_3N
f. SO_2
g. CuOH
h. $Zn(NO_2)_2$
i. V_2S_3

63. Write the formulas for the following compounds:

a. silicon dioxide
b. nickel (III) sulfide
c. manganese (II) phosphate
d. diboron tetrabromide
e. magnesium sulfate heptahydrate
f. potassium carbonate
g. ammonium oxide
h. carbon tetrachloride