CH 151 Problem Set #3

Complete problem set on separate pieces of paper showing all work, circling final answers, etc.

Covering: **Chapter Two and Chapter Three**
Important Tables and/or Constants: 1 mol = 6.022×10^{23}

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1. Name each of the following fixed-charge binary ionic compounds.
    a. BeS
    b. $GaCl_3$
    c. CaO
    d. Cd_3P_2
2. Name each compound in the following pairs of variable-charge binary ionic compounds.
    a. $SnCl_4$ and $SnCl_2$
    b. FeS and Fe_2S_3
    c. Cu_3N and Cu_3N_2
    d. NiO and Ni_2O_3
3. Name each of the following binary ionic compounds.
    a. Au_2O
    b. Ag_2O
    c. CuCl
    d. KCl
4. Write chemical formulas for the following variable-charge binary ionic compounds, given their names.
    a. iron(II) chloride
    b. iron(III) chloride
    c. gold(I) oxide
    d. gold(I) iodide
5. Write chemical formulas for both ions in each of the following pairs of polyatomic ions.
    a. nitrate and nitrite
    b. chlorate and perchlorate
    c. cyanide and azide
    d. phosphate and phosphite
6. In which of the following pairs of compounds are polyatomic ions present in both members of the pair?
    a. SO_3 and $CaSO_4$
    b. NH_4Br and KClO
    c. Cu_2CO_3 and $CuCO_3$
    d. Na_2SO_4 and Na_2S
7. Name each compound in the following pairs of polyatomic ion containing compounds.
    a. $CuNO_3$ and $Cu(NO_3)_2$
    b. $Pb_3(PO_4)_2$ and $Pb_3(PO_4)_4$
    c. $Mn(CN)_3$ and $Mn(CN)_2$
    d. $Co(ClO_3)_2$ and $Co(ClO_3)_3$

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8. Write chemical formulas for the following compounds containing polyatomic ions.
    a. copper(II) sulfate
    b. manganese(III) hydroxide
    c. ammonium nitrate
    d. magnesium phosphate
9. Name the following binary molecular compounds.
    a. S_4N_2
    b. SO_3
    c. IF_7
    d. N_2O_4
10. Write chemical formulas for the following binary molecular compounds.
    a. disulfur monoxide
    b. tetraphosphorus hexoxide
    c. carbon dioxide
    d. silicon tetrachloride
11. Name each of the following compounds as acids.
    a. $HClO_3$
    b. $HClO_4$
    c. H_2S
    d. HCl
12. Supply the missing name in each of the following pairs of name-formula combinations
    a. HIO_3 (iodic acid); HIO (?)
    b. H_2SeO_4 (selenic acid); H_2SeO_3 (?)
    c. HBrO (hypobromous acid); $HBrO_4$ (?)
    d. HNO_2 (nitrous acid); HNO_3 (?)
13. Calculate the molar mass of each of the following substances.
    a. $NaHCO_3$ (baking soda, or sodium bicarbonate)
    b. Tl_2SO_4 (thallium(I) sulfate, a rat and ant poison)
    c. $C_5H_8NO_4Na$ (monosodium glutamate, or MSG, a flavor enhancer used in cooking)
    d. $C_{20}H_{24}N_2O_2$ (quinine, an antimalarial drug)
14. Calculate the percent composition for each of the following compounds. (Round off all atomic masses to 0.01 amu before using them.)
    a. $C_{10}H_8$ (naphthalene, ingredient in some mothballs)
    b. NaCN (sodium cyanide, used to extract gold from ores)
15. A sample of the compound sodium azide, NaN_3, contains 57.08 g of Na. How many grams of N does it contain?
16. How many particles (atoms, molecules, formula units or ions) are present in 1.00 mole of each of the following?
    a. copper (Cu) atoms
    b. ammonia (NH_3) molecules
    c. potassium carbonate (K_2CO_3) formula units
    d. phosphate (PO_4^{3-}) ions

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17. Calculate the number of molecules present in each of the following samples of molecular compounds.
    a. 4.69 moles CO
    b. 0.433 mole SO_3
    c. 1.44 moles P_2H_4
    d. 2.307 moles H_2O_2
18. Calculate the mass, in grams, of 0.981 mole of each of the following compounds.
    a. SO_2
    b. SO_2Cl_2
    c. S_4N_4
    d. $Li_2S_2O_3$
19. A 0.571 mole sample of a pure substance has a mass of 36.60 g. What is the molal mass of the substance?
20. Calculate the number of atoms present in a 3.752 g sample of each of the following elements.
    a. Li
    b. V
    c. Hg
    d. Pb
21. Each of the following is a correctly written molecular formula. In each case write the empirical formula for the substance.
    a. As_4O_6
    b. Pb_3S_4
    c. C_4H_8
    d. C_5H_{12}
22. Given the following percent compositions, determine the empirical formula.
    a. 47.26% Cu and 52.74% Cl
    b. 40.27% K, 26.78% Cr, and 32.96% O
23. Determine the molecular formulas of compounds with the following empirical formulas and molecular masses.
    a. CB_2H_3, 73.3 amu
    b. P_2O_3, 220 amu
    c. $C_5H_{10}O_2$, 102 amu
    d. $SNCl_2$, 351 amu
24. Adipic acid, a compound used in the manufacture of nylon, has a molecular mass of 146 amu. Its percent composition by mass is 49.30% C, 6.9l% H, and 43.79% O. Determine the molecular formula of adipic acid.

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