Brooklyn College. Chemistry 1. First lecture test. Fall, 2012

Name (Print) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Since except in the multiple choice questions, partial credit may be possible, be sure to clearly show all work. (multiple choice questions are 2 points each)

1. In the space below, write the chemical formulas for the following compounds. (4pts)

 a) potassium sulfate b) barium nitrate c) Ammonium carbonate

 d) dinitrogen pentoxide.

2. Give the correct names for a) Na2S b) FePO4 c) CBr4

 (4 pts) d) HC2H3O2

 e) Which of these formulas is NOT an empirical formula? Explain.

(2pts)

\_\_\_\_\_\_3. Rank these events in the order in which they occurred:

 a) Chadwick discovers the neutron

 b) Thomson discovers the electron

 c) Rutherford discovers the nucleus

 d) Dalton states the atomic theory.

 A) d,c,b,a B) d,b,c,a C) b,d, a, c D) b,c, a,d

\_\_\_\_\_\_4. To the correct number of significant figures, how many milligrams is 0.6250 grams? A) 625 grams milligrams B) 625.0 milligrams

 C) 0.006825 milligrams D) 0.00068250 milligrams

\_\_\_\_\_\_5. Which is the symbol for a particle containing 12 protons, 14 neutrons, and 10 electrons? A) 24Mg2+ B) 26Mg2+ C) 22Ne2 D) 26Mg2 E) 24Mg2

(3pts)

\_\_\_\_\_\_6. How many protons, neutrons, and electrons, respectively are

 are there in 33S ? A) 16, 16, 16 B) 16, 17, 18 C) 16, 17, 16

 D) 17, 16, 17 E) 17, 16, 16

\_\_\_\_\_\_7. Of these particles: Al3+ K+ Ba2+ O2- and Br- which two have

 the same number of electrons? A) Al3+ and O2- B) K+ and Ba2+

 C) O2- and Br- D) Al3+ and K+

\_\_\_\_\_\_8. What is the charge on a Magnesium ion? A) 2- B) 2 + C) 7 + D) 4-

9. Write balanced equations for the following reactions, using the smallest possible whole numbers: ( 3 points each)

 a) Aluminum reacts with copper (II) sulfate to form aluminum sulfate and copper.

 b) Butane, C4H10 burns in air to produce carbon dioxide and water.

 c) HgO ➞ Hg2O + O2

\_\_\_\_\_\_10. What is the formula mass of calcium nitrate?

 A) 102 B) 164 C) 142 D) 204

\_\_\_\_\_\_\_11 Which pair of compounds have the same % compositions?

 a) BaO and BaO2 b) HC2H3O2 and C6H12O6 c) C2H6 and C3H8

d) H2C2O4 and H2CO3

\_\_\_\_\_\_\_12 Which contains the greatest % nickel by mass? a) NiS b) Ni2S3

 c) NiO d) Ni2S3

\_\_\_\_\_\_\_13. What is the molar mass of a compound, if the mass of 0.250 moles of that

 compound is 45.0 grams ? A) 11.2 B) 180 C) 90.0 D) 154

\_\_\_\_\_\_\_14. Find the number of moles of CO in 5.60 grams of CO.

 A) 5.00 mole B) 2.00 mole C) 0.200 mole D) 0.500 mole

\_\_\_\_\_\_\_15. How many moles of neon are there in 1.2 x 1022 molecules of neon?

 A) 2.0 x 102 B) 2.0 x 10-2 C) 5.0 x 10-1 D) 2.0 x 1044

\_\_\_\_\_\_16. Find the mass of 1.5 x 1023 molecules of water. A) 0.25 grams

 B) 4.5 grams C) 45 grams D) 72 grams

\_\_\_\_\_17. How many molecules of sulfuric acid are present in a sample of H2SO4 which contains 32.0 grams of oxygen? A) 1.2 x 1023 B) 3.0 x 1023

 C) 6.0 x 1023 D) 1.2 x 1024

. \_\_\_18 The diagram to the right could most likely represent

 a) the empirical formula of sulfuric acid

 b) the structural formula of sulfuric acid

 c) the empirical formula of acetic acid

 d) the structural formula of phosphoric acid.

\_\_\_\_\_\_19 The best conductor of electricity, of the following , is a mixture containing water and a) sugar b) acetic acid c) BaCO3 d) NaNO3

\_\_\_\_\_\_20. Acetic acid is considered a weak electrolyte because

 a) it is only slightly soluble in water b) it is only a monoprotic acid

 c) it is only slightly ionized in water d) it does not contain a metal

\_\_\_\_\_\_\_21. Given the reaction

 3 Cu(s) + 8 HNO3(aq) ➞ 2 NO(g) + 4 H2O(ℓ) + 3 Cu(NO3)2

If 3.00 moles of Cu are added to a solution containing 4.00 moles of HNO3 , what is the maximum yield of NO(g) ? A) 1.00 mole B) 2.00 moles C) 4.50 moles

 D) 8.00 moles

\_\_\_\_\_\_\_22. What is the molarity of an H2SO4 solution prepared by adding 50.0 mL of 2.50 molar H2SO4 to 200. mL of water? A) 0.625 M B) 0.500 M C) 10.0 M

 D) 12.5 M

\_\_\_\_\_\_\_23. How many grams of NaOH must be dissolved to a volume of 250. mL to produce a 2.00 molar solution of NaOH? A) 500.g B) 0.500 g C) 20.0 g

 D) 80.0 g

Please solve the problems in the answer booklet.

Problem I. Ammonia gas, NH3 is formed by the direct combination of hydrogen gas and nitrogen gas.

a) Write a balanced equation for the reaction. ( 2 pts)

b) How many moles of ammonia can be formed from 12.00 grams of hydrogen, with sufficient nitrogen? ( 3 pts)

II. Determine the % iron by mass in Fe2O3 .

( 3 pts)

 III. Copper (II) chloride is soluble in water.

A. Provide the formula for another soluble substance which will form a precipitate when added to a solution of copper (II) chloride. ( 2 pts)

B. Write a balanced **net ionic equation** for the reaction between a solution of the salt you selected in part A, and a solution of copper(II) chloride. ( 3 pts)

Problem IV Given the reaction: 2 Fe + 6 HCl ➞ 2 FeCl3 + 3 H2

120.0 grams of iron react with a solution containing 292.0 grams of HCl.

 ( MM of HCl is 36.5 g)

a) Which reactant is the limiting factor in this reaction? ( 1 pt)

b) How many grams of hydrogen gas are produced, assuming that the limiting reactant is used up? ( 3 pts)

c) How many grams of the reactant which is NOT limiting remain when the reaction is complete ? ( 3 pts)

V. A compound is 41.07 % K, 33.72 % S, and also contains oxygen. Find the empirical formula for the compound. ( 3 pts)

VI. Find the **molecular** formula of a hydrocarbon which is 80.0 % carbon by mass and has a molecular mass of 30.0. ( 3 pts)

VII. When alcohols are burned in excess oxygen, they produce water and CO2.

When 10.00 grams of a certain alcohol is burned, it produces 14.19 grams of CO2 and 8.710 grams of water. (alcohols contain carbon, hydrogen and oxygen)

A. Find the empirical formula of the alcohol. ( 3 pts)

B. Find the actual molecular formula for the alcohol, if it is known to contain 2 carbons. ( 2 pts)

VIII. The reaction 2 C2H5OH ➞ C2H5OC2H5 + H2O is performed under conditions where the maximum % yield of C2H5OC2H5 is 80.0 %. Under these conditions, what is the maximum amount of C2H5OC2H5 obtainable from 4.60 grams of C2H5OH ? ( 4 pts)

IX. Chlorine gas can be prepared by heating a mixture of HCl and MnO2.

 4 HCl(aq) + MnO2(s) ➞ MnCl2(aq) + Cl2(g) + 2 H2O(ℓ)

 ( molar masses: Cl2 = 70.9 , MnO2 = 86.9 )

 Enough HCl(aq) is added to completely react 17.38 grams of MnO2

 A. How many grams of Cl2 gas are produced? ( 3 pts)

 B. If the reaction required 50.0 mL of HCl, what is the molarity of the HCl? ( 3 pts)