AP Chemistry

Test 1. Fall 2011

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (first 30 questions are 2 pts each)

\_\_\_\_\_\_1. The volume of water in a graduated cylinder is read as 28.5 mL. When an insoluble solid object is added, the volume is read as 33.5 mL. The solid object was found to have a mass of 40.00 grams. The density of the object, to the correct number of significant figures is

A) 5 g/mL B) 5.0 g/mL C) 8 g/mL D) 8.0 g/mL E) 8.00 g/mL

\_\_\_\_\_2. When the measurement 0.050 grams is correctly expressed in scientific notation, with the correct number of sig. figs., it should be

A) 5 x102 B) 5.0 x 102 C) 5 x10−2 D) 5.0 x 10−2  E) 5.0 x 10−3

\_\_\_\_\_3. Thomson's "cathode ray" experiments established

A) the charge of a proton B) the existence of the proton

C) the mass of an electron D) the existence of an electron

E) the nuclear structure of the atom

\_\_\_\_\_4. The Roman numeral "III" must appear in the correct chemical name of the compound A) FePO4 B) Al(NO3)3 C) CuNO3

D) NiSO4 E) SO3

\_\_\_\_\_5. Based on the symbol , the particle contains

A) 28 protons, 26 neutrons, and 28 electrons

B) 28 protons, 32 neutrons, and 30 electrons

C) 32 protons, 28 neutrons and 30 electrons

D) 28 protons, 28 neutrons, and 26 electrons

E) 28 protons, 32 neutrons, and 26 electrons.

\_\_\_\_\_6. The atomic number of an ion is equivalent to its

A) number of neutrons B) number of electrons

C) nuclear charge D) atomic mass E) mass number

Write the correct chemical formula for each of the following:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_7. Aluminum sulfate

\_\_\_\_\_\_\_\_\_\_\_\_\_\_8. Cobalt (II) carbonate

\_\_\_\_\_\_\_\_\_\_\_\_\_\_9. Dinitrogen trisulfide

\_\_\_\_\_\_\_\_10. The compound with the formula Cu2SO3 would be called

A) copper (I) sulfite B) copper (I) sulfate

C) copper (II) sulfite D) copper (II) sulfate

E) copper (III) sulfate

\_\_\_\_\_\_\_\_11. How many nanometers, nm, are there in one millimeter, mm?

A) 1 x 103 B) 1 x 10−3C) 1 x 106 D) 1 x 10 −6 E) 1 x 109

\_\_\_\_\_\_\_\_12. What is the mass in grams of 3.01 x 1022 molecules of SO2 ?

A) 3.2 grams B) 32 grams C) 12.8 grams D) 128 grams

E) 16 grams

\_\_\_\_\_\_\_\_13. What quantity of water contains the same number of moles as

11.0 grams of CO2 ? A) 7.2 grams B) 4.5 grams C) 72 grams

D) 0.25 grams E) 0.75 grams

\_\_\_\_\_\_\_14. What quantity of water contains the same number of **oxygen atoms** as 44.0 grams of CO2 ? A) 18.0 grams B) 9.0 grams

C) 36.0 grams D) 44.0 grams E) 88.0 grams

\_\_\_\_\_\_\_15. Which salt is least soluble in water?

A) KCl B) PbCl2 C) AgNO3 D) Na2SO4 E) NH4Br

\_\_\_\_\_\_\_16. What is the symbol for a particle that contains 16 protons, 17 neutrons, and 18 electrons? A) S2+ B) S− C) S2− D) Cl− E) Ar

\_\_\_\_\_\_\_17. Which of the following substances is the strongest electrolyte?

A) HNO3 B) NH3 C) C6H12O6 D) HC2H3O2 E) HF

\_\_\_\_\_\_\_18. The % carbon by mass in acetic acid is

A) 36 % B) 40. % C) 53 % D) 19 % E) 42 %

\_\_\_\_\_\_\_19. A substance that has the empirical formula CH *might* have a molar mass of A) 6.5 B) 21 C) 72 D) 78 E) 100.

\_\_\_\_\_\_\_20. When the equation C4H10 + O2 → CO2 + H2O is correctly balanced using the smallest possible whole number coefficients, the coefficient before the O2 is A) 3 B) 4 C) 7 D) 13 E) 16

\_\_\_\_\_\_\_21. The reaction shown in question 20 is best described as

A) synthesis B) decomposition C) single replacement

D) metathesis E) combustion

\_\_\_\_\_\_22. How many moles of NH3 can be formed from 6.0 moles of H2 gas in excess N2? A) 2.0 B) 3.0 C) 4.0 D) 6.0 E) 8.0

\_\_\_\_\_\_23. In the reaction 2 Al + 6 HCl → 2 AlCl3 + 3 H2

If 2.7 grams of aluminum react completely with excess HCl, how many grams of hydrogen gas are formed?

A) 0.15 B) 0.30 C) 4.1 D) 0.20 E) 0.40

\_\_\_\_\_\_24. A sample of a hydrocarbon is found upon analysis to contain

2.8 grams of carbon and 0.35 grams of hydrogen. What is the empirical formula for the hydrocarbon?

A) CH2 B) C2H3 C) C2H5 D) C8H E) CH3

\_\_\_\_\_25. What is the mass in grams of 6.33 mol of NaHCO3?

A) 13.3 B) 126 C) 532 D) 1120 E) 1420

\_\_\_\_\_26. In Mendeleev's Periodic Table, elements were placed in the same vertical columns on the basis of A) number of valence electrons

B) similar chemical properties C) similar boiling points

D) atomic numbers

\_\_\_\_\_27. Which two substances have exactly the same % compositions?

A) C2H6 and C2H4 B) H2O and H2S C) C2H2 and C6H6

D) N2O3 and NO2 E) C12H22O11 and C6H12O6

\_\_\_\_\_28. How many grams of pure sulfuric acid (MM=98) must be dissolved to in water to produce a 2.00 molar solution of the acid in a volume of 250 mL? A) 49 grams B) 196 grams C) 24.5 grams

D) 4900 grams E) 245 grams

\_\_\_\_\_\_29. How many mL of 2.00 molar HNO3 are required to completely neutralize a solution containing 3.70 grams of Ca(OH)2 ? (MM=74.0)

A) 50.0 mL B) 100. mL C) 25.0 mL D) 250 mL. E) 500. mL

\_\_\_\_\_\_30. When 100. mL of 1.00 M Ba(NO3)2 is mixed with 200. mL of

1.00 M KNO3 , what is the concentration of nitrate ion in the resulting mixture? A) 1.00 M B) 1.33 M C) 2.00 M D) 2.50 M E) 3.00 M

Problems: ( show work for part credit) Answer all remaining questions in the essay booklets provided.

I. Ethanol is produced in a fermentation reaction, (MM of glucose is 180, ethanol ,46.0)

C6H12O6(aq) → 2 CO2(g) + 2 C2H5OH(aq)

If the fermentation of 18.0 grams of glucose produces just a 10.0% yield of C2H5OH(aq) , how many grams of ethanol are produced? (5pts)

II. Aldehydes are compounds that contain only C, H, and O.

A certain aldehyde has a molar mass of 72.0

When 2.00 grams of this aldehyde is burned completely, the products are 4.89 grams of CO2 and 2.00 grams of H2O.

A. What is the empirical formula of the aldehyde? (6 pts)

B. What is the actual molecular formula of the aldehyde? ( 2 pts)

III. Sodium hydroxide reacts with iron(III) chloride, forming a red precipitate.

A. What is the formula of the precipitate? ( 3 pts)

B. Write a balanced equation for the reaction. ( 4 pts)

C. The molar mass of NaOH is 40.0, while that of Iron (III) chloride is

162. A solution containing 4.00 grams of NaOH is reacted with one containing 8.10 gram of FeCl3 .

1. Which reactant is the limiting factor? Show work. (3)

2. How many **moles** of the precipitate are formed? (3)

3. How many moles of the non-limiting reactant remain unreacted? (3)

IV. In the following reaction: 2 CH3OH → (CH3)2O + H2O

10.0 grams of CH3OH reacts to yield 6.20 grams of (CH3)2O , what is the % yield? (4)

V. In an analysis for tin (II) ion, a solution containing some of the ion is reacted with permanganate. The net ionic equation for the reaction is

2 MnO4−(aq) + 5 Sn2+(aq) + 16 H+ (aq) → 2 Mn2+(aq) + 5 Sn4+(aq) + 8 H2O(ℓ)

40.00 mL of 0.200 molar KMnO4 (the K+ is a spectator) are needed to completely react with all of the Sn2+ ions present in the solution.

A. How many moles of permanganate ion reacted with the tin (II) ions? (3)

B. How many moles of tin (II) ions were present in the solution? (3)

C. What mass of tin, in grams, was present in the tested solution? (3)

Extra Credit:

KClO3 → KCl + O2 (not balanced)

How many pounds of potassium chlorate are needed in order to produce

100.0 pounds of O2? ( Molar mass of KClO3 is 123\_)