Chemistry 141 Name

Dr. Cary Willard

Exam 1a February 25, 2013

Multiple Choice (30 points)

Page 5 (14 points)

Page 6 (12 points)

Page 7 (10 points)

Page 8 (18 points)

Page 9 (17 points)

Page 10 (12 points)

Total (113 points)

Percent (100 %)

All work must be shown to receive credit. Give all answers to the correct number of significant figures

Avogadros number = 6.022 x 1023 /mol



4 quarts = 1 gallon

36 in = 1 yard

12 in = 1 ft

1 cc = 1cm3 = 1 mL

Area of a circle = πr2

Volume of a sphere = 4/3 πr3

Grossmont College

Periodic Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IA |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | VIIA | NOBLE GASES |
| 1  **H**  1.008 | IIA |  |  |  |  |  |  |  |  |  | |  | IIIA | IVA | VA | VIA | 1  **H**  1.008 | 2  **He**  4.002 |
| 3  **Li**  6.941 | 4  **Be**  9.012 |  |  |  |  |  |  |  |  |  | |  | 5  **B**  10.81 | 6  **C**  12.01 | 7  **N**  14.01 | 8  **O**  16.00 | 9  **F**  19.00 | 10  **Ne**  20.18 |
| 11  **Na**  23.00 | 12  **Mg**  24.30 | IIIB | IVB | VB | VIB | VIIB | VIII VIII VIII | | | | IB | IIB | 13  **Al**  27.00 | 14  **Si**  28.09 | 15  **P**  30.97 | 16  **S**  32.06 | 17  **Cl**  35.45 | 18  **Ar**  39.95 |
| 19  **K**  39.10 | 20  **Ca**  40.08 | 21  **Sc**  44.96 | 22  **Ti**  47.90 | 23  **V**  50.94 | 24  **Cr**  52.00 | 25  **Mn**  54.94 | 26  **Fe**  55.85 | 27  **Co**  58.93 | 28  **Ni**  58.70 | | 29  **Cu**  63.55 | 30  **Zn**  65.38 | 31  **Ga**  69.72 | 32  **Ge**  72.59 | 33  **As**  74.92 | 34  **Se**  78.96 | 35  **Br**  79.90 | 36  **Kr**  83.80 |
| 37  **Rb**  85.47 | 38  **Sr**  87.62 | 39  **Y**  88.91 | 40  **Zr**  91.22 | 41  **Nb**  92.91 | 42  **Mo**  95.94 | 43  **Tc**  (99) | 44  **Ru**  101.1 | 45  **Rh**  102.9 | 46  **Pd**  106.4 | 47  **Ag**  107.9 | | 48  **Cd**  112.4 | 49  **In**  114.8 | 50  **Sn**  118.7 | 51  **Sb**  121.8 | 52  **Te**  127.6 | 53  **I**  126.9 | 54  **Xe**  131.3 |
| 55  **Cs**  132.9 | 56  **Ba**  137.3 | 57  **La**  138.9 | 72  **Hf**  178.5 | 73  **Ta**  180.9 | 74  **W**  183.9 | 75  **Re**  186.2 | 76  **Os**  190.2 | 77  **Ir**  192.2 | 78  **Pt**  195.1 | 79  **Au**  197.0 | | 80  **Hg**  200.6 | 81  **Tl**  204.4 | 82  **Pb**  207.2 | 83  **Bi**  209.0 | 84  **Po**  (209) | 85  **At**  (210) | 86  **Rn**  (222) |
| 87  **Fr**  (223) | 88  **Ra**  226.0 | 89  **Ac**  227.0 | 104  **Rf**  (261) | 105  **Db**  (262) | 106  **Sg**  (263) | 107  **Bh**  (262) | 108  **Hs**  (265) | 109  **Mt**  (266) | 110  **??**  (269) |  | |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 58  **Ce**  140.1 | 59  **Pr**  140.9 | 60  **Nd**  144.2 | 61  **Pm**  (147) | 62  **Sm**  150.4 | 63  **Eu**  152.0 | 64  **Gd**  157.3 | 65  **Tb**  158.9 | 66  **Dy**  162.5 | 67  **Ho**  164.9 | 68  **Er**  167.3 | 69  **Tm**  168.9 | 70  **Yb**  173.0 | 71  **Lu**  175.0 |
| 90  **Th**  232.0 | 91  **Pa**  231.0 | 92  **U**  238.0 | 93  **Np**  (237) | 94  **Pu**  (244) | 95  **Am**  (243) | 96  **Cm**  (247) | 97  **Bk**  (247) | 98  **Cf**  (251) | 99  **Es**  (252) | 100  **Fm**  (257) | 101  **Md**  (258) | 102  **No**  (259) | 103  **Lr**  (260) |

Lanthanide series

Actinide series

Multiple Choice (30 points) – Give the best answer for each of the following questions.

1. Bromine belongs to the \_\_\_\_\_\_\_\_ group of the periodic table.
   1. halogen
   2. alkaline earth metal
   3. alkali metal
   4. noble gas
2. Which one of the following statements about temperature scales is **false**?
   1. TheCelsius degree is smaller than the Fahrenheit degree.
   2. The freezing point of water on theCelsius scale is 0 degrees.
   3. The boiling point of water on the Fahrenheit scale is 212 degrees.
   4. All temperatures on the Kelvin scale are positive numbers.
3. Which of the following statements does not describe a **chemical** property of oxygen?
   1. When coal is burned in oxygen, the process is called combustion.
   2. Iron will rust in the presence of oxygen.
   3. Oxygen combines with carbon to form carbon dioxide gas.
   4. The pressure is caused by collision of oxygen molecules with the sides of a container.
4. Which of the following is **not** explained by Dalton's atomic theory?
   1. the law of multiple proportions
   2. conservation of mass during a chemical reaction
   3. the existence of more than one isotope of an element
   4. the law of definite proportions
5. Which of the following two atoms are isotopes?
   1. and 
   2. and 
   3. and 
   4. and 
6. How many protons (p) and neutrons (n) are in an atom of 
   1. 90 p, 38 n
   2. 38 p, 90 n
   3. 38 p, 52 n
   4. 52 p, 38 n
7. A banana split is an example of
   1. an element.
   2. a heterogeneous mixture.
   3. a homogeneous mixture.
   4. a compound.
8. How many electrons are in the ion, P3-?
   1. 12
   2. 28
   3. 34
   4. 18
9. Which of the compounds, Li3P, PH3, C2H6, IBr3, are ionic compounds?
   1. only C2H6
   2. only Li3P
   3. PH3, C2H6, and IBr3
   4. Li3P and PH3
10. The solid compound, Na2CO3, contains
    1. Na+, C4+, and O2- ions.
    2. Na+ ions and CO32-ions.
    3. Na2CO3 molecules.
    4. Na2+ and CO32- ions.
11. How many H+ ions can the acid H3PO4 donate per molecule?
    1. 3
    2. 2
    3. 1
    4. 0
12. Which statement about diluted solutions is **false**? When a solution is diluted
    1. the number of moles of solvent remains unchanged.
    2. the concentration of the solution decreases.
    3. the number of moles of solute remains unchanged.
    4. the molarity of the solution decreases.
13. Which statement about elemental analysis by combustion is **not** correct?
    1. Only carbon and hydrogen can be determined directly from CO2 and H2O.
    2. Oxygen is determined from the amount of H2O formed.
    3. Hydrogen is determined from the amount of H2O formed.
    4. Carbon is determined from the amount of CO2 formed.
14. HBr, HCl, HClO4, KBr, and NaCl are all classified as
    1. weak electrolytes.
    2. acids.
    3. strong electrolytes.
    4. nonelectrolytes.
15. What reagent could **not** be used to separate Cl- from OH- when added to an aqueous solution containing both?
    1. AgNO3 (*aq*)
    2. Cu(NO3)2 (*aq*)
    3. Ca(NO3)2 (*aq*)
    4. Fe(NO3)2 (*aq*)

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. BaCl2  barium chloride
   2. NaHSO4 sodium hydrogen sulfate
   3. Cr(NO3)6 chromium(VI) nitrate
   4. H3PO4 phosphoric acid
   5. SiCl4 silicon tetrachloride
2. (5 points) Write the correct formula for each of the following compounds
   1. Nickel(II) hypoiodite Ni(IO)2
   2. Silver phosphide Ag3P
   3. Sodium chromate Na2CrO4
   4. Xenon hexafluoride XeF6
   5. Perchloric acid HClO4*(aq)*
3. (4 points) Perform the following calculation and report your answer with the correct number of significant figures.
4. (6 points) It is a very rainy February in San Diego this year. If I have just built a round fish pond in my backyard with a diameter of 6.18 feet, how many liters of water will collect in the fish pond if there are 4.08 in of rain this month. (Assume that none of the water collected will evaporate over the course of the month.)
5. (6 points) A certain element X forms a compound with oxygen in which there are two atoms of X for every three atoms of O. In this compound, 3.998 g of X is combined with 1.000 g of oxygen. Identify the element X.

Element must be molybdenum

1. (10 points) Complete the following double displacement reactions with balanced molecular, total ionic, and net ionic equations.

Cu(NO3)2*(aq)* + H3PO4*(aq)* 🡪

3 Cu(NO3)2*(aq)* + 2 H3PO4*(aq)* 🡪 Cu3(PO4)2*(s)* + 6 HNO3*(aq)*

Balanced total ionic equation

3 Cu+2*(aq)* + 6 NO3-1*(aq)* + 2 H3PO4*(aq)* 🡪 Cu3(PO4)2*(s)* + 6 H+1*(aq)* + 6 NO3-1*(aq)*

Balanced net ionic equation

3 Cu+2*(aq)* + 2 H3PO4*(aq)* 🡪 Cu3(PO4)2*(s)* + 6 H+1*(aq)*

NiSO4*(aq)* + NH3*(aq)* 🡪

NiSO4*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)*🡪 Ni(OH)2*(s)* + (NH4)2SO4*(aq)*

Balanced total ionic equation

Ni2+*(aq)* + SO42-*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)* 🡪 Ni(OH)2*(s)* + 2 NH4+*(aq)* + SO42-*(aq)*

Balanced net ionic equation

Ni2+*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)* 🡪 Ni(OH)2*(s)* + 2 NH4+*(aq)*

1. (18 points) Splenda, a non-caloric sweetener, is composed of sucralose, an analog of sucrose which is not digestable. The chemical formula for sucralose is C12H19Cl3O8.
   1. Calculate the molar mass of sucralose.
   2. Calculate the number of moles of carbon in 7.64 moles of sucralose.
   3. Calculate the number of molecules of sucralose that contains 684 atoms of hydrogen.
   4. Calculate the mass of sucralose that contains 5.922 x 1024 atoms of carbon.
   5. Calculate the mass in grams of one molecule of sucralose.
   6. Calculate the number of grams of water that will be formed by the combustion of enough sucralose to form 61.88 g of carbon dioxide.
2. (5 points) How many grams of copper are in 250.0 mL of a 19.6 % solution of copper (II) chloride with a density of 1.284 g/mL?
3. (12 points) The reaction of hydrazine, N2H4, with hydrogen peroxide, H2O2, has been used in rocket engines. One way these compounds react is described by the equation

N2H4 + 7 H2O2 🡪 2 HNO3 + 8 H2O

* 1. How many moles of nitric acid will be formed by the complete reaction of 5.81 moles of peroxide?
  2. How many grams of hydrazine are required to produce 200.0 grams of water?
  3. How many molecules of water will be produced by the complete reaction of 20.0 grams of hydrazine?
  4. If 2.842 x 1024 molecules of water are formed from the reaction in part c, what is the percent yield for the reaction?

1. (12 points) You mix 427.0 mL of 0.2754 M sodium carbonate with 400.0 mL of 0.6684 M iron(III) bromide. Write the reaction and determine the number of grams of iron(III) carbonate produced, and the final concentration of all ions in the solution.

Balanced chemical equation (Check with me before you go on to be sure this is correct.)

3 Na2CO3*(aq)* + 2 FeBr3*(aq)* 🡪 6 NaBr*(aq)* + Fe2(CO3)3*(s)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | X = 0.0392 |  | X=0.1337mol |  |  |  |  |
|  | 3 Na2CO4(aq) | + | 2 FeBr3(aq) | 🡪 | 6 NaBr(aq) | + | Fe2(CO3)3(s) |
| I | 0.1176 mol |  | 0.2674 mol |  | 0 mol |  | 0 mol |
|  | -3x |  | -2x |  | +6x |  | + x |
| E | 0.1176 – 3x |  | 0.1671-2x |  | 6x |  | 1x |
|  | =0.1176-3(.0392)  =0 mol |  | =0.2674-2(.0392)  =0.1890mol |  | =6(0.0392)  =0.2352 mol |  | =0.0392 mol |

Moles Fe2(CO3)3 produced 0.0392 mol Mass Fe2(CO3)3 produced 11.4 g

Moles Na+1 = 0.2352 mol [Na+1] = 0.2844M

Moles CO3-2 = 0 mol [CO3-2] = 0 M

Moles Fe+3 = 0.1890 mol [Fe+3] = 0.2285 M

Moles Br-1 = 0.8022 mol [Br-1] = 0.9700 M