Chemistry 141 Name

Dr. Cary Willard

Exam 1b February 27, 2014

Multiple Choice (30 points)

Page 5 (10 points)

Page 6 (12 points)

Page 7 (12 points)

Page 8-9 (10 points)

Page 10 (18 points)

Page 11 (12 points)

Total (104 points)

Percent (100 %)

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

Avogadro’s 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) |  | |  |  |  |  |  |  |  |

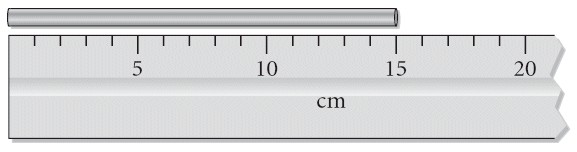
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 58  **Ce**  140.1 | 59  **Pr**  140.9 | 60  **Nd**  144.2 | 61  **Pm**  (147) | 62  **Sm**  150.4 | 63  **Eu**  152.0 | 64  **Gd**  157.3 | 65  **Tb**  158.9 | 66  **Dy**  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. Molecules can be described as
   1. mixtures of two or more pure substances.
   2. two or more atoms chemically joined together.
   3. mixtures of two or more elements that has a specific ratio between components.
   4. heterogeneous mixtures.
   5. homogeneous mixtures.
2. Which of the following statements about the phases of matter is TRUE?
   1. In both solids and liquids, the atoms or molecules pack closely to one another.
   2. Solids are highly compressible.
   3. Gaseous substances have long-range repeating order.
   4. There is only one type of geometric arrangement that the atoms or molecules in any solid can adopt.
   5. Liquids have a large portion of empty volume between molecules.
3. Identify the description of an atom.
   1. neutrons and electrons in nucleus; protons in orbitals
   2. neutrons in nucleus; protons and electrons in orbitals
   3. protons and neutrons in nucleus; electrons in orbitals
   4. protons and electrons in nucleus; neutrons in orbitals
   5. electrons in nucleus; protons and neutrons in orbitals
4. Which of the following represents a chemical property of hydrogen gas?
   1. It reacts explosively with oxygen.
   2. It is gaseous at room temperature.
   3. It is less dense than air.
   4. It is colorless.
   5. It is tasteless.
5. A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 1.79 g/mL, 1.81 g/mL, 1.80 g/mL, 1.81 g/mL. If the actual value for the density of the sugar solution is 1.80 g/mL, which statement below best describes her results?
   1. Her results are precise, but not accurate.
   2. Her results are accurate, but not precise.
   3. Her results are neither precise nor accurate.
   4. Her results are both precise and accurate
   5. It isn't possible to determine with the information given.
6. All samples of a given compound, regardless of their source or how they were prepared, have the same proportions of their constituent elements. Which law does this refer to?
   1. Law of the Conservation of Mass
   2. Law of Modern Atomic Theory
   3. Law of Multiple Proportions
   4. First Law of Thermodynamics
   5. Law of Definite Proportions
7. Two or more substances in variable proportions, where the composition is constant throughout are
   1. a compound.
   2. an element.
   3. a heterogeneous mixture.
   4. a homogeneous mixture.
   5. a crystalline solid.
8. The Scientific Method
   1. is just a theory.
   2. is a strict set of rules and procedures that lead to inarguable fact.
   3. isn't used much in modern chemistry.
   4. is based on continued observation and experiment.
   5. is a framework for proving an argument you know to be true.
9. What answer should be reported, with the correct number of significant figures, for the following calculation? (249.362 + 41) / 63.498
   1. 4.57277
   2. 4.5728
   3. 4.573
   4. 4.57
   5. 4.6
10. Read the length of the metal bar with the correct number of significant figures.



* 1. 15 cm
  2. 15.0 cm
  3. 15.00 cm
  4. 20 cm
  5. 15.000 cm

1. Choose the statement below that is TRUE.
   1. A strong acid solution consists of only partially ionized acid molecules.
   2. The term "weak electrolyte" means that the substance is inert.
   3. A molecular compound that does not ionize in solution is considered a strong electrolyte.
   4. A weak acid solution consists of mostly nonionized acid molecules.
   5. The term "strong electrolyte" means that the substance is extremely reactive.
2. An atom of 118Xe contains \_\_\_\_\_\_\_\_ neutrons.
   1. 54
   2. 172
   3. 64
   4. 110
   5. 118
3. Which of the following statements is FALSE according to Dalton's Atomic Theory?
   1. Atoms combine in simple whole number ratios to form compounds.
   2. All atoms of chlorine have identical properties that distinguish them from other elements.
   3. One carbon atom will combine with one oxygen atom to form a molecule of carbon monoxide.
   4. Atoms of sodium do not change into another element during chemical reaction with chlorine.
   5. An atom of nitrogen can be broken down into smaller particles that will still have the unique properties of nitrogen.
4. Which of the following statements about isotopes is TRUE?
   1. Isotopes of the same element differ only in the number of electrons they contain.
   2. An isotope of an atom with a larger number of neutrons is larger than an isotope of the same atom that contains fewer neutrons.
   3. Some elements have 3 or more naturally occurring isotopes.
   4. Isotopes of the same element have the same mass.
   5. Isotopes of the same element don't usually have the same properties.
5. Which of the following is **NOT** a strong electrolyte?
   1. NaOH
   2. CaCl2
   3. CaCO3
   4. NaC2H3O2
   5. K2SO4

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. (NH4)3P ammonium phosphide
   2. Cu3PO4 copper(I) phosphate or cuprous phosphate
   3. P2O7 diphosphorous heptoxide
   4. Ag2O silver oxide
   5. KMnO4 potassium permanganate
2. (5 points) Write the correct formula for each of the following compounds
   1. sodium acetate NaC2H3O2
   2. trisulfur pentachloride S3Cl5
   3. zinc perchlorate Zn(ClO4)2
   4. ferric hydroxide Fe(OH)3
   5. sulfuric acid H2SO4
3. (6 points) Copper can be drawn into thin wires. How many kilometers of 34 gauge wire (diameter = 6.304 x 10-3 in) can be produced from the 6.74 lb of covallite, an ore of copper that is 66.0% copper by mass (Hint: Treat the wire as a cylinder: the density of copper is 8.95 g/cm3, figure out the mass of copper wire per unit length.)
4. (6 points) An element X forms both a dichloride (XCl2) and a tetrachloride (XCl4). Treatment of 10.00 g XCl2 with excess chlorine forms 13.73 g XCl4. Calculate the atomic mass of X. Predict its identity.
5. (6 points)Aqueous copper(II) nitrate (Cu(NO3)2) is mixed with aqueous ammonia (NH3). Write the conventional, total ionic, and net ionic equations for this reaction.

Balanced conventional equation

Cu(NO3)2(aq) + 2~~NH~~~~3~~(aq)NH4OH🡪Cu(OH)2(s) + 2NH4NO3(aq)

Cu(NO3)2(aq) + 2NH3(aq) +2H2O(l)🡪Cu(OH)2(s)+2NH4NO3(aq)

Balanced total ionic equation

Cu+2(aq) + 2NO3-1(aq) + 2NH3(aq) + 2H2O(l) 🡪 Cu(OH)2(s) + 2NH4+1(aq) + 2NO3-1(aq)

Balanced net ionic equation

Cu+2(aq) + 2NH3(aq) + 2H2O(l) 🡪 Cu(OH)2(s) + 2NH4+1(aq)

1. (6 points) Balance the following redox reaction in acidic solution

H2O2(aq) + Ti+2(aq) 🡪 H2O(l) + Ti+3(aq)

2e-1 + 2 H+1 + H2O2(aq) 🡪 2 H2O(l)

2(Ti+2(aq) 🡪 Ti+3(aq) + 1e-1)

H2O2(aq) + 2 Ti+2(aq) + 2 H+1 🡪 2 H2O(l) + 2 Ti+3(aq)

1. (5 points) Balance the following redox half reaction that occurs in basic solution

SbH3(g) 🡪 Sb(s)

SbH3(g) 🡪 Sb(s) + 3 H+1 + 3 e-1

3 H+1 (aq) + 3 OH-1 (aq) 🡪 3 H2O(l)

SbH3(g) + 3 OH-1 (aq) 🡪 Sb(s) + 3 H2O(l) + 3 e-1

1. (5 points) Toilet bowl cleaners often contain hydrochloric acid, which dissolves the calcium carbonate deposits that accumulate within a toilet bowl. A 25.00 mL sample of a toilet bowl cleaner is titrated with 42.74 mL of a 0.253 M solution of potassium hydroxide. What is the molarity of hydrochloric acid in the toilet bowl cleaner?
2. (18 points) Acetaminophen, an analgesic, has the molecular formula C8H9O2N.
   1. Calculate the molar mass of acetaminophen.
   2. Calculate the number of moles of carbon in 6.74 moles of acetaminophen.
   3. Calculate the number of molecules of acetaminophen that contains 3.51 mol of oxygen.
   4. Calculate the mass of acetaminophen that contains 6.824 x 1025 atoms of carbon.
   5. Write the equation for the complete combustion of acetaminophen. (N will form NO2 gas)

4 C8H9O2N + 45 O2 🡪 32 CO2 + 18 H2O + 4 NO2

* 1. Calculate the mass of carbon dioxide that will be formed from the complete combustion of 51.3 g of acetaminophen.

1. (12 points) You mix 527.0 mL of 0.2754 M sodium carbonate with 250.0 mL of 0.6684 M chromium(III) chloride. Write the reaction and determine the number of grams of chromium(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 CrCl3*(aq)* 🡪 6 NaCl*(aq)* + Cr2(CO3)3*(s)*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | X = 0.0484 mol |  | X=0.0836mol |  |  |  |  |
|  | 3 Na2CO4(aq) | + | 2 CrCl3(aq) | 🡪 | 6 NaCl(aq) | + | Cr2(CO3)3(s) |
| I | 0.1451 mol |  | 0.1671 mol |  | 0 mol |  | 0 mol |
|  | -3x |  | -2x |  | +6x |  | + x |
| E | 0.1451 – 3x |  | 0.1671-2x |  | 6x |  | 1x |
|  | =0.1451-3(.0484)  =0 mol |  | =0.1671-2(.0484)  =0.0703mol |  | =6(0.0484)  =0.2904 mol |  | =0.0484 mol |

Moles Cr2(CO3)3 produced 0.0484 mol Mass Cr2(CO3)3 produced 13.7 g

Moles Na+1 = 0.2904 mol [Na+1] = 0.3737M

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

Moles Cr+3 = 0.0703 mol [Cr+3] = 0.0905 M

Moles Cl-1 = 0.5013 mol [Cl-1] = 0.6452 M