Chemistry 141 Name

Martin Larter

Exam 1a February 22, 2016

Multiple Choice (30 points)

Page 5 (15 points)

Page 6 (22 points)

Page 7 (18 points)

Page 8 (18 points)

Total (103 points)

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. Which one of the following statements is *not* correct?
   1. Sodium and chlorine are elements.
   2. Sodium chloride (table salt) is a compound.
   3. Sodium chloride is a pure substance.
   4. Sodium chloride is a heterogeneous mixture.
   5. Sodium chloride added to water forms a solution.
2. John Dalton postulated that all matter is composed of small particles called atoms. For this proposition to be considered a valid scientific theory, \_\_\_\_\_\_\_\_\_\_
   1. It must be supported by experimental evidence and testing.
   2. It must be impossible to prove wrong by experiment.
   3. All possible experiments must never find an exception to it.
   4. Some, but only a few, experiments may find exceptions to it.
   5. It must be voted on by the scientific community and accepted by all.
3. For each of the elements below, there are only two naturally occurring isotopes. Using information in your periodic table, identify the pair in which the lighter isotope is the more abundant one.

|  |  |  |
| --- | --- | --- |
| 1. 6Li and 7Li | 1. 191Ir and 193Ir | 1. 79Br and 81Br |
| 1. 50V and 51V | 1. 10B and 11B |  |

1. The law of constant composition states that \_\_\_\_\_\_\_\_\_
   1. Compounds such as NO2 and SO2 have identical chemical properties.
   2. The elements forming a particular compound always combine in the same proportions.
   3. Nitrogen and oxygen can combine to form NO or NO2.
   4. Compounds such as NO and NO2 have identical chemical properties.
   5. Only one compound can be produced when two elements combine.
2. Which statement is correct?
   1. Electrons, protons, and neutrons have about the same mass.
   2. Electrons have a much smaller mass than that of protons and neutrons.
   3. Neutrons are much more massive than protons.
   4. Protons are much more massive than neutrons.
   5. Electrons have a much larger mass than that of protons and neutrons.
3. When you place a piece of dry ice (solid carbon dioxide) on a plate at room temperature, you notice that no liquid forms, unlike ice that melts to form liquid water. This is because dry ice \_\_\_\_\_\_\_\_\_\_
   1. As a liquid quickly evaporates.
   2. Undergoes deposition instead of melting.
   3. Sublimes instead of melting.
   4. Does not exist in the liquid form at room temperature and pressure.
   5. Contains no water.
4. An example of a chemical property of formaldehyde (CH2O) is \_\_\_\_\_\_\_\_\_\_
   1. It is flammable.
   2. It dissolves in water.
   3. It has a density of 1.09 g/mL.
   4. It is a gas at room temperature.
   5. It is colorless.
5. Gallium has an atomic mass of 69.723 amu. The abundance of Ga-69 (68.926 amu) is 60.11%. What is the atomic mass, in amu, of the other isotope?

|  |  |  |
| --- | --- | --- |
| 1. 70.924 amu | 1. 70.928 amu | 1. 70.932 amu |
| 1. 70.920 amu | 1. 70.930 amu |  |

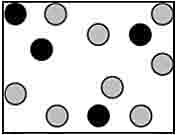
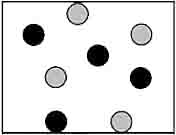
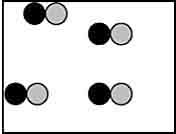
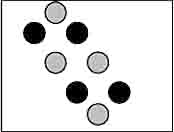
1. The proof of liquor is defined as the percentage of ethanol it contains times two. If vodka is 80 proof, what is the solvent in vodka?

|  |  |  |
| --- | --- | --- |
| 1. vodka | 1. water | 1. ethanol |
| 1. not enough information to answer | 1. the same as the solute in this case | |

1. Which statement about the following chemical reaction is *not* correct?

2H2 + O2 → 2H2O

* 1. For every oxygen molecule consumed, two water molecules are produced.
  2. For every two hydrogen molecules consumed, two water molecules are produced.
  3. Two hydrogen molecules react with one oxygen molecule.
  4. Four hydrogen molecules react with one oxygen to produce two water molecules.
  5. Four hydrogen atoms combine with two oxygen atoms to produce two water molecules.

1. Which statement about a balanced chemical reaction equation is always correct?
   1. The total number of moles of the products equals the total number of moles of the reactants.
   2. The number of atoms of each kind is the same for the products as for the reactants.
   3. The sum of the stoichiometric coefficients for the products equals the sum of the stoichiometric coefficients for the reactants.
   4. The sum of the masses of gaseous reactants equals the sum of the masses of gaseous products.
   5. The sum of the masses of solid products equals the sum of the masses of solid reactants.
2. Which picture best represents an atomic-level view of a nonelectrolyte solution (water molecules not shown)?

a b c d

1. In a demonstration of strong electrolytes, weak electrolytes, and nonelectrolytes, Professor Popsnorkle used a lightbulb apparatus that showed how much a solution conducted electricity by the brightness of the lightbulb. When pure water was tested, the bulb did not light. Then Professor Popsnorkle tested the following aqueous solutions. Which one caused the bulb to burn dimly but not brightly?

|  |  |  |
| --- | --- | --- |
| 1. table salt, NaCl | 1. acetic acid, CH3COOH | 1. ethanol, CH3CH2OH |
| 1. methanol, CH3OH | 1. table sugar, C12H22O11 |  |

1. Which one of the following statements regarding a strong acid is *not* correct?
   1. A strong acid ionizes completely in water.
   2. A strong acid ionizes in water to produce hydronium ions.
   3. A strong acid neutralizes bases.
   4. HCl is an example of a strong acid.
   5. Acids are only strong at a high concentration.
2. Which statements regarding combustion analysis to determine percent composition are *not* correct?
   * 1. The mass of oxygen in the sample compound can be determined from the mass of carbon dioxide that is produced.
     2. If a compound contains an element other than carbon and hydrogen, combustion analysis cannot be used to determine its empirical formula.
     3. Combustion analysis data alone is not sufficient to determine the molecular formula with certainty.
     4. If some CO is produced rather than all CO2, then the empirical formula that is calculated will be too high in carbon.

|  |  |  |
| --- | --- | --- |
| 1. i and ii are not correct. | 1. ii and iii are not correct. | 1. i, ii, and iii are not correct. |
| 1. i, ii, and iv are not correct | 1. ii, iii, and iv are not correct. |  |

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. Na2SO4
   2. BaCO3
   3. HNO3
   4. CCl4
   5. Co(C2H3O2)3
2. (5 points) Write the correct formula for each of the following compounds
   1. Potassium permanganate
   2. Ammonium phosphate
   3. Ferric bromite
   4. Sulfurous acid
   5. Chromium(VI) sulfide
3. (5 points) A plastic material called HDPE or high-density polyethylene was once evaluated for use in impact-resistant hulls of small utility boats for the United States Navy. A cube of this material measures 1.20 x 10−2 yd on a side and has a mass of 3.52 x 10−3 lb. Seawater at the surface of the ocean has a density of 1.03 g/cm3. Will this cube float on water?
4. (5 points) The lowest temperature measured on Earth is −128.6oF, recorded at Vostok, Antarctica, in July 1983. What is this temperature on the Celsius and Kelvin scales?
5. (5 points) A student investigated the accuracy and precision of a volumetric flask and gathered the data below:

Rated volume 750.0 mL

Rated uncertainty +/− 0.3 mL

Number of trials 20

Average volume contained 750.1 mL

Standard deviation 0.6 mL

Rate the precision and accuracy of the volumetric flask as good, fair, or poor and explain why you chose these ratings.

1. (6 points) Fill in the missing information in the following table of ions and atoms

|  |  |  |
| --- | --- | --- |
| Symbol |  |  |
| Number of Protons |  | 23 |
| Number of Neutrons |  | 25 |
| Number of Electrons |  | 26 |
| Mass Number |  |  |

1. (6 points) Write a conventional and net ionic equation for the reaction of H3PO4 (aq) and Ba(OH)2(aq).
2. (10 points) 1.6510 M sulfuric acid is required to completely react with 37.5 mL of 1.20 M sodium phosphate?

2 Na3PO4 (aq) + 3 H2SO4 (aq) 🡪 2 H3PO4 (aq) + 3 Na2SO4 (aq)

* 1. What volume (in mL) of sulfuric acid needed for this neutralization reaction?
  2. What was the molarity of the sodium ion at the end of the neutralization reaction?
  3. A 0.2249 M solution of sulfuric acid is prepared by diluting 0.06530 L of the 1.6510 M solution of sulfuric acid. How much water in mL is needed to produce the dilute solution?

1. (8 points) The combustion of 0.405 g of a compound containing C, H, and O, extracted from the bark of the sassafras tree, produces 1.100 g of CO2 and 0.225 g of H2O. The molar mass of the compound is 162 g/mol. Determine it’s empirical and molecular formulas.
2. (8 points) A sample of jasmatone, a common ingredient in soaps and lotions, has a molecular formula of C11H20O.
   1. What is the mass of a sample of jasmatone that contains 45.0 g of carbon?
   2. How many micromoles of hydrogen are found in a sample of jasmatone that contains 2.09 x 1018 atoms of C?
3. (10 points) Disulfide dichloride (S2Cl2) is used in the vulcanization of rubber, a process that prevents the slippage of rubber molecules past one another when stretched. It is prepared by heating sulfur in an atmosphere of chlorine:

S8(l) + 4 Cl2(g) 🡪 4 S2Cl2(l)

What is the theoretical yield of S2Cl2 in grams when 5.06 g of S8 are heated with 6.24 g of Cl2? If the actual yield of S2Cl2 is 6.55 g, what is the percent yield? Use the IΔE method to solve this problem.

Mass S2Cl2 produced Percent yield=

Mass S8 remaining = Mass Cl2 remaining =