Chemistry 141 Name

Dr. Cary Willard

Exam 1a February 23, 2012

Multiple Choice (30 points)

Page 5 (14 points)

Page 6 (17 points)

Page 7 (14 points)

Page 8 (8 points)

Page 9 (12 points)

Page 10 (10 points)

Total (105 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

Grossmont College

Periodic Table

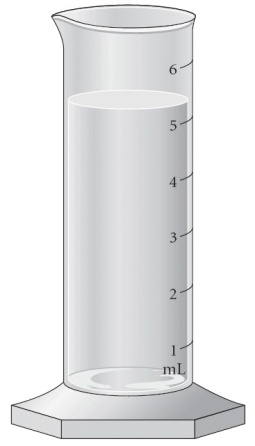
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| IA |  |  |  |  |  |  |  |  |  |  | |  |  |  |  |  | VIIA | NOBLE GASES |
| 1  **H**  1.008 | IIA |  |  |  |  |  |  |  |  |  | |  | 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 of the following represents a *hypothesis*?
   1. Sodium reacts with water to form sodium hydroxide and hydrogen gas.
   2. Nitrogen gas is a fairly inert substance.
   3. Nickel has a silvery sheen.
   4. When a substance combusts, it combines with air.
   5. When wood burns, heat is given off.
2. Dalton's Atomic Theory states
   1. that all elements have several isotopes.
   2. that matter is composed of small indestructible particles.
   3. that the properties of matter are determined by the properties of atoms.
   4. that energy is neither created nor destroyed during a chemical reaction.
   5. that an atom is predominantly empty space.
3. Choose the pure substance from the list below.
   1. tea
   2. a casserole
   3. carbon monoxide
   4. sugar water
   5. pomegranate juice
4. Two or more substances in variable proportions, where the composition is constant throughout are
   1. a compound.
   2. an element.
   3. a homogeneous mixture.
   4. a heterogeneous mixture.
   5. a crystalline solid.
5. Which of the following are examples of physical change?
   1. sugar is dissolved in water
   2. coffee is brewed
   3. dry ice sublimes
   4. ice (solid water) melts
   5. All of these are examples of physical change.
6. A student performs an experiment to determine the density of a sugar solution. She obtains the following results: 1.71 g/mL, 1.73 g/mL, 1.67 g/mL, 1.69 g/mL. If the actual value for the density of the sugar solution is 1.40 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 both precise and accurate
   4. Her results are neither precise nor accurate.
   5. It isn't possible to determine with the information given.
7. The mass number is equal to
   1. the sum of the number of the electrons and protons.
   2. the sum of the number of protons and neutrons.
   3. the sum of the number of the neutrons and electrons.
   4. the sum of the number of protons, neutrons, and electrons.
8. What is the identity of element Q if the ion Q2+ contains 10 electrons?
   1. C
   2. O
   3. Ne
   4. Mg
9. Read the water level with the correct number of significant figures.
   1. 5.3 mL
   2. 5.32 mL
   3. 5.320 mL
   4. 5.3200 mL
   5. 5 mL
10. 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.
11. What is the empirical formula for C4H10O2?
    1. C2H5O
    2. CHO
    3. C2H4O
    4. CHO2
    5. CH2O
12. Which of the following exists as a diatomic molecule?
    1. C
    2. P
    3. N
    4. Na
    5. Ne
13. Choose the statement below that is TRUE.
    1. A weak acid solution consists of mostly nonionized acid molecules.
    2. The term "strong electrolyte" means that the substance is extremely reactive.
    3. A strong acid solution consists of only partially ionized acid molecules.
    4. The term "weak electrolyte" means that the substance is inert.
    5. A molecular compound that does not ionize in solution is considered a strong electrolyte.
14. What element is undergoing reduction (if any) in the following reaction?

Zn(s) + 2 AgNO3(aq) → Zn(NO3)2(aq) + 2 Ag(s)

* 1. Zn
  2. Ag
  3. N
  4. O
  5. This is not an oxidation-reduction reaction.

1. Identify the oxidation state of H in H2(g).

Mg(s) + 2HCl(aq) → MgCl2(aq) + H2(g)

* 1. +1
  2. +2
  3. 0
  4. -1
  5. -2

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. CaCO3  calcium carbonate
   2. Li2CrO4 lithium chromate
   3. PCl5 phosphorus pentachloride
   4. Al(BrO2)3 aluminum bromite
   5. MnF4 manganese (IV) fluoride
2. (5 points) Write the correct formula for each of the following compounds
   1. Silver phosphate Ag3PO4
   2. Sulfur dioxide SO2
   3. Ammonium chloride NH4Cl
   4. Nickel(III) periodate Ni(IO4)3
   5. Magnesium hydroxide Mg(OH)2
3. (4 points) Perform the following calculation and report your answer with the correct number of significant figures. Be sure to include units!
4. (6 points) One liter of gasoline in an automobile’s engine produces on the average 2.50 kg of carbon dioxide, which is a greenhouse gas, that is, it promotes the warming of Earth’s atmosphere. Calculate the annual production of carbon dioxide in tons if there are 47.5 million cars in the United States and each car covers a distance of 5520 mi at a consumption rate of 21.4 miles per gallon. (1 ton = 2000 lb)
5. (6 points) Myoglobin stores oxygen for metabolic processes in muscle. Chemical analysis shows that it contains 0.34 percent Fe by mass. What is the molar mass of myoglobin? (There is one Fe atom ber molecule.)
6. (5 points) A sample of 0.8439 g of an unknown compound containing barium ions (Ba2+) is dissolved in water and treated with an excess of Na2SO4. If the mass of the BaSO4 precipitate formed is 0.4105 g, what is the percent by mass of Ba in the original unknown compound?
7. (6 points) Complete the following double displacement reaction with balanced molecular, total ionic, and net ionic equations.

K2CrO4*(aq)* + Ca(C2H3O2)2*(aq)* 🡪

K2CrO4*(aq)* + Ca(C2H3O2)2*(aq)* 🡪 CaCrO4*(aq)* + 2 KC2H3O2*(aq)*

Balanced total ionic equation

2 K+*(aq)* + CrO42-*(aq)* + Ca2+*(aq)* + 2 C2H3O2-*(aq)* 🡪 CaCrO4*(s)* + 2 K+*(aq)* + 2 C2H3O2-*(aq)*

Balanced net ionic equation

CrO42-*(aq)* + Ca2+*(aq)* 🡪 CaCrO4*(s)*

1. (8 points) Given the following REDOX reaction, identify the elements oxidized and reduced, and the oxidizing and reducing agent.

KMnO4(aq) + 5 FeBr2(aq) + 8 HBr(aq) 🡪 MnBr2(aq) + 5 FeBr3(aq) + 4 H2O(l) + KBr(aq)

Element oxidized Fe

Element reduced Mn

Oxidizing agent KMnO4

Reducing agent FeBr2

1. (8 points) Peroxyacylnitrate (PAN) is one of the compounds of smog. An analysis of the compound gives the following percent composition by mass: C: 19.8%; H: 2.50%; N: 11.6%; and the remainder is oxygen. Calculate its empirical formula. What is its molecular formula given that its molar mass is about 120 g?

Molar mass = 121 so molecular and empirical formulas are the same.

1. (12 points) Melittin or bee venom has a molecular formula C131H229N39O31. Answer the following questions regarding phencyclidine.
   1. Calculate the molar mass of melittin.
   2. Calculate the number of moles of carbon in 3.68 moles of melittin.
   3. Calculate the number of molecules of melittin that contains 916 atoms of hydrogen.
   4. Calculate the mass of melittin that contains 7.378 x 1024 atoms of carbon.
   5. If 64.2 g of melittin is dissolved in hexane to a total volume of 750.0 mL, what is the molarity of the solution?
   6. Calculate the mass in grams of one molecule of melittin.
2. (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 IE method to solve this problem.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **X=0.0158** |  | X=0.0220 |  |  |
|  | S8 | + | 4 Cl2 | 🡪 | 4 S2Cl2 |
| I | 0.0197 mol |  | 0.0880 mol |  | 0 mol |
|  | - 1x mol |  | - 4x mol |  | + 4x mol |
| E | 0.0197-x |  | 0.0880-4x |  | 4x |
|  | 0 mol |  | 0.0092 mol |  | 0.0789 mol |

Mass S2Cl2 produced Percent yield=

Mass S8 remaining = Mass Cl2 remaining =