Chemistry 115 Name

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Exam 2A October 19, 2009

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|  | Points Earned | Points Possible |
| Page 1  multiple choice |  | 24 |
| Page 2 |  | 24 |
| Page 3 |  | 24 |
| Page 4 |  | 18 |
| Page 5 |  | 10 |
|  |  |  |
| Total |  | 100 |

Note: All work must be shown to receive credit. On calculation problems show answer with the correct number of significant figures using scientific notation if necessary.

Avogadro’s number 6.022 x 1023/mol

PERIODIC CHART

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| 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 | Transition Metals | | | | | | | | | | 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 | VIIIB | | | 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**  (268) | 110  **??**  (???) |  |  |  |  |  |  |  |  |

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| 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

Part 1 - Multiple Choice (24 points)

1. Each atom of a specific element has the same
   1. Atomic mass
   2. Number of neutrons
   3. Number of protons
   4. Mass number
   5. None of the above
2. The following reaction: H2 + I2 → 2HI, is an example of
   1. Combination
   2. Decomposition
   3. Single-displacement
   4. Double-displacement
   5. Unable to determine
3. The following reaction: K + NaBr → KBr + Na, is an example of
   1. Combination
   2. Decomposition
   3. Single-replacement
   4. Double-displacement
   5. Unable to determine
4. In which pair would both compounds have the same empirical formula?
   1. C2H4 and C3H6
   2. K2CrO4 and K2Cr2O7
   3. NaHCO3 and Na2CO3
   4. FeCl3 and FeCl2
5. One isotope of carbon has the atomic number 6 and the mass number 14. A neutral atom of this isotope contains
   1. 8 protons
   2. 14 neutrons
   3. 6 neutrons
   4. 6 electrons
6. Which statement is incorrect?
   1. One mole contains 6.02 X 1023 molecules.
   2. One molar mass equals one mole.
   3. One mole equals 6.02 X 1023 g of a compound.
   4. One mole of water contains the same number of molecules as one mole of carbon dioxide.
7. Isotopes of an element always have the same
   1. Mass number
   2. Number of neutrons
   3. Number of subatomic particles
   4. Atomic number
8. The electrical charge of a nucleus is
   1. Positive
   2. Negative
   3. The nucleus has no charge, it is neutral.
   4. The charge on the nucleus may be positive or negative.
9. The nucleus of an atom usually contains
   1. Protons
   2. Neutrons
   3. Electrons
   4. Both protons and electrons
   5. Both protons and neutrons
10. Reactions which liberate heat are
    1. Endothermic
    2. Exothermic
    3. Isothermic
    4. Protothermic
    5. Thermometric

Given the activity series Mg>Zn>Cu>Ag, predict the products of the following reactions.

1. Mg + AgNO3 🡪
   1. Mg(NO3)2 + Ag
   2. MgNO3 + Ag
   3. MgAg + 2 NO3
   4. No reaction
   5. Unable to determine based on information provided
2. Cu + Mg(NO3)2 🡪
   1. CuNO3 + Mg
   2. Cu(NO3)2 + Mg
   3. Cu2Mg + NO3
   4. No reaction
   5. Unable to determine based on information provided

Part 2 – Nomenclature (8 points) Fill in the following table with the correct IUPAC name or formula

|  |  |
| --- | --- |
| IUPAC Name | Chemical Formula |
| Nickel(II) nitrate |  |
| Sodium phosphide |  |
| Barium hydroxide |  |
| Lithium hypobromite |  |
|  | NH4Cl |
|  | ZnSO4 |
|  | Ti(ClO2)3 |
|  | CI4 |

Part 3 – Problems (68 points)

1. (4 points) Explain why the mass of a carbon atom is about twice the mass of the protons in a carbon atom. What accounts for the difference in mass?
2. (4 points) The number of which subatomic particle determines the identity of an element?
3. (4 points) What are two types of evidence to indicate that a chemical reaction has occurred? (i.e. What will you observe?)
4. (4 points) What do we mean when we say that a substance is aqueous?
5. (6 points) Balance the equations below
   1. NH3(g) + O2(g) → NO2(g) + H2O(g)
   2. K2CrO4*(aq)* + Ti(NO3)3 (aq) → KNO3(aq) + Ti2(CrO4)3(s)
6. (18 points) Given a 21.5 g sample of glycerin (C3H8O3), a substance commonly found in hand lotions, calculate the following:
   1. molar mass of glycerin
   2. moles of glycerin in the sample
   3. moles of carbon atoms in the glycerin sample
   4. molecules of glycerin in the sample
   5. number of oxygen atoms in the glycerin sample
   6. the mass of one molecule of glycerin
7. (18 points) Butane gas (C4H10) is frequently sold for use in camping stoves. Use the balanced equation for its combustion in oxygen gas to answer the following questions.

2 C4H10(g) + 13 O2(g) ⎯⎯→ 8 CO2(g) + 10 H2O(g)

* 1. How many moles of oxygen are required to react with 6.42 mol C4H10?
  2. How many grams of carbon dioxide will be produced when 4.68 g of C4H10 are burned?
  3. If 19.5 grams of CO2 are produced in part b, what is the percent yield of the reaction?
  4. How many molecules of butane will react with 312 molecules of oxygen gas?
  5. How many molecules of water will be produced by the combustion of 3.00 g of butane?
  6. How many g of CO2 will be produced by the reaction of 6.54 moles of butane with 15.1 moles of oxygen gas?

1. (6 points) Calculate the empirical formula of vanillin which is composed of 63.15% C, 5.30% H, and 31.55% O.
2. (4 points) A compound with empirical formula C3H5N has a molar mass of 220 g/mol. Determine the molecular formula for the compound.