Chemistry 115 Name Key

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Exam 2A March 17, 2010

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|  | Points Earned | Points Possible |
| Page 1  multiple choice |  | 26 |
| Page 2 |  | 15 |
| Page 3 |  | 12 |
| Page 4 |  | 18 |
| Page 5 |  | 18 |
| Page 6 |  | 11 |
|  |  |  |
| 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 (26 points)

1. Neutral atoms of a specific element may have different
   1. Number of protons
   2. Number of electrons
   3. Number of neutrons
   4. Atomic number
   5. None of these may be different
2. Which pair of formulas illustrates the Law of Multiple Proportions?
   1. CH3Cl and CH3OH
   2. H2O and HOH
   3. CH3CH3 and CBr3CBr3
   4. CuCl2 and CuBr
   5. H2O and H2O2
3. What charge does a molecule possess?
   1. Positive
   2. Neutral
   3. Negative
   4. Credit
   5. Unable to determine
4. Which pair of symbols represents isotopes?
   1. and
   2. and
   3. and
   4. and
5. The mass of an atom is primarily determined by the mass of its
   1. Protons
   2. Neutrons
   3. Electrons
   4. Both protons and neutrons
   5. Both neutrons and electrons
6. How many moles of HF will be produced by the complete reaction of 1.42 moles of H2 in the following equation?

H2 + F2 → 2HF

* 1. 0.710
  2. 2.84
  3. 1.42
  4. 2.00
  5. 5.68

1. In which pair would both compounds have the same empirical formula?
   1. K2CrO4 and K2Cr2O7
   2. NaHCO3 and Na2CO3
   3. FeCl3 and FeCl2
   4. KClO2 and KClO4
   5. C2H4 and C3H6
2. Which is not part of Dalton’s atomic model?
   1. Elements are composed of minute, indivisible particles called atoms.
   2. Atoms of the same element are alike in mass.
   3. Atoms of the same element can be different in size.
   4. Chemical compounds are composed of two or more atoms of different elements.
   5. All of the above are part of Daltons atomic model.
3. An atom of atomic number 61 and mass number 142 contains how many neutrons
   1. 81
   2. 61
   3. 142
   4. 31
   5. 203
4. Which of the following contains the largest number of moles?
   1. 1.0 g Al
   2. 1.0 g Ag
   3. 1.0g U
   4. 1.0 g Na
   5. They all have the same number of moles.
5. Which statement is incorrect?
   1. One mole contains 6.02 X 1023 molecules.
   2. One molar mass equals one mole.
   3. One mole of water contains the same number of molecules as one mole of carbon dioxide.
   4. One mole of copper has a mass of 63.55 g
   5. One mole equals 6.02 X 1023 g of a compound.
6. The reaction

K + NaBr → KBr + Na

is an example of

* 1. A single displacement reaction
  2. A combination reaction
  3. A decomposition reaction
  4. A double displacement reaction
  5. A gas formation reaction

1. The reaction

CaCO3 → CaO + CO2

is an example of

* 1. A combination reaction
  2. A single displacement reaction
  3. A decomposition reaction
  4. A double displacement reaction
  5. Unable to determine

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

|  |  |
| --- | --- |
| IUPAC Name | Chemical Formula |
| Calcium phosphate | Ca3(PO4)2 |
| Nickel(III) bromide | NiBr3 |
| Potassium permanganate | KMnO4 |
| Zinc nitrite | Zn(NO2)2 |
| sodium carbonate | Na2CO3 |
| Silver oxide | Ag2O |
| Lithium hydroxide | LiOH |
| Diboron tetroxide | B2O4 |

Part 3 – Problems (66 points)

1. (4 points) Explain why the name for MgCl2 is magnesium chloride but the name for CuCl2 is copper(II) chloride.

Magnesium has only one possible charge or oxidation state and therefore the charge of the atom magnesium ion does not need to be included in the name. Copper has 2 possible charges or oxidation states and therefore the charge on the ion must be specified in the name.

1. (3 points) Explain how endothermic reactions differ from exothermic reactions.

Endothermic reactions require energy to occur and exothermic reactions produce energy when they occur.

1. (6 points) Balance the equations below
   1. 2 Be*(s)*+ O2*(g)* → 2 BeO*(s)*
   2. 4 CH3NH2*(g)* + 9 O2*(g)* → 10 H2O*(g)* + 4 CO2*(g)* + 2 N2*(g)*
2. (6 points) Given the following data determine the relative activities of the metals from each equation series for Ca, Cd, Mg, and Ni.

Mg + Cd(NO3)2 🡪 Cd + Mg(NO3)2 Mg >Cd

Ca + Mg(NO3)2 🡪 Ca(NO3)2 + Mg Ca >Mg

Ni+ Cd(NO3)2 🡪 no reaction Cd >Ni

* 1. Using the data from the first part of this problem, determine the activity series for Ca, Cd, Mg, and Ni.

Ca > Mg > Cd > Ni

* 1. Predict what would happen if a strip of nickel were dropped into a solution of Mg(NO3)2.

No reaction would occur

1. (18 points) Given a 3.85 g sample of the cyanoacrylate (C5H5NO2) the principle component of superglue, calculate the following:
   1. molar mass of cyanoacrylate
   2. moles of cyanoacrylate
   3. moles of carbon atoms
   4. molecules of cyanoacrylate
   5. number of oxygen atoms
   6. mass in grams of one molecule of cyanoacrylate (give 4 significant figures)
2. (18 points) Given the reaction

2 Al(s) + 3NH4NO3(s) ⎯⎯→ 3 N2 + 6 H2O + Al2O3

* 1. How many moles of NH4NO3 are required to react with 6.42 mol Al?
  2. How many grams of nitrogen gas(N2) will be produced when 5.97 mol of aluminum are reacted with excess NH4NO3?
  3. If 238 grams of N2 are produced in part b, what is the percent yield of the reaction?
  4. How many atoms of Al will react with 132 formula units of NH4NO3?
  5. How many molecules of water will be produced by the combustion of 4.00 g of Al?
  6. How many grams of Al2O3 will be produced by the reaction of 0.250 moles of Al with 0.250 moles of NH4NO3?

1. (7 points) Calculate the empirical formula of a compound which is composed of 35.00% N, 5.04% H and 59.96% O.
2. (4 points) A compound with empirical formula C3H4O2 has a molar mass of 360 g/mol. Determine the molecular formula for the compound.