Chemistry 141 Name

Dr. Cary Willard

Exam 1a February 22, 2011

Multiple Choice (30 points)

Page 5 (14 points)

Page 6 (14 points)

Page 7 (10 points)

Page 8 (14 points)

Page 9 (15 points)

Page 10 (15 points)

Total (112 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. A consistent explanation of known observations is called
   1. an experiment.
   2. a prediction.
   3. a hypothesis.
   4. a theory.
2. Which of the following statements does not describe a **chemical** property of oxygen?
   1. The pressure is caused by collision of oxygen molecules with the sides of a container.
   2. When coal is burned in oxygen, the process is called combustion.
   3. Iron will rust in the presence of oxygen.
   4. Oxygen combines with carbon to form carbon dioxide gas.
3. A student measured the diameter of a sphere and determined the average value. His measurements are 6.17cm, 6.16cm, 6.16cm and 6.17cm If the true diameter is 6.18 cm, what can be said about the student's results?
   1. It is accurate and precise.
   2. It is accurate but not precise.
   3. It is precise but not accurate.
   4. It is neither precise nor accurate.



1. To the correct number of significant figures, what is the temperature reading on the following Celsius thermometer?
   1. 15oC
   2. 15.67 oC
   3. 16 oC
   4. 15.6 oC
2. Which of the following is **not** explained by Dalton's atomic theory?
   1. the existence of more than one isotope of an element
   2. the law of multiple proportions
   3. conservation of mass during a chemical reaction
   4. the law of definite proportions
3. How many protons (p) and neutrons (n) are in an atom of calcium-46?
   1. 26 p, 20 n
   2. 46 p, 60 n
   3. 20 p, 26 n
   4. 20 p, 46 n
4. In which set do all elements tend to form cations in binary ionic compounds?
   1. Li, B, O
   2. Mg, Cr, Pb
   3. O, F, Cl
   4. N, As, Bi
5. The solid compound, Na2CO3, contains
   1. Na+, C4+, and O2- ions.
   2. Na2CO3 molecules.
   3. Na+ ions and CO32-ions.
   4. Na2+ and CO32- ions.
6. How many H+ ions can the acid, H2CO3, donate per molecule?
   1. 0
   2. 1
   3. 3
   4. 2
7. Which one of the following statements about balanced equations is **false**? In a balanced reaction
   1. mass must be conserved.
   2. net charge must be balanced on both sides of the reaction arrow.
   3. molecules must be balanced on both sides of the reaction arrow.
   4. atoms must be balanced on both sides of the reaction arrow.
8. Which statement about diluted solutions is **false**? When a solution is diluted
   1. the number of moles of solvent remains unchanged.
   2. the concentration of the solution decreases.
   3. the number of moles of solute remains unchanged.
   4. the molarity of the solution decreases.
9. HBr, HCl, HClO4, KBr, and NaCl are all classified as
   1. strong electrolytes.
   2. weak electrolytes.
   3. acids.
   4. nonelectrolytes.
10. What reagent could be used to separate Br- from NO3- when added to an aqueous solution containing both?
    1. NaI (*aq)*
    2. Ba(OH)2 (*aq)*
    3. CuSO4 (*aq)*
    4. AgNO3 (*aq)*
11. What is the oxidation number of the oxygen atom in H2O2?
    1. -1
    2. +2
    3. +1
    4. -2
12. Which species functions as the oxidizing agent in the following reduction-oxidation reaction:

5 Fe+2(aq) + MnO4-1(aq) + 8 H+1(aq) 🡪 Mn+2(aq) + 5 Fe+3(aq) + 4 H2O(aq)

* 1. Mn2+(*aq*)
  2. H+(*aq*)
  3. Fe2+(*aq*)
  4. MnO4-(*aq*)

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. SrBr2  strontium bromide
   2. AlPO4 aluminum phosphate
   3. Cl2O7 dichorine heptoxide
   4. LiClO2 lithium chlorite
   5. V(NO3)5 vanadium(V) nitrate
2. (5 points) Write the correct formula for each of the following compounds
   1. Ammonium hypoiodite NH4IO
   2. Zinc bromide ZnBr2
   3. Ferric sulfate Fe2(SO4)3
   4. Mercury(I) carbonate Hg2CO3
   5. Sulfur dioxide SO2
3. (4 points) Perform the following calculation and report your answer with the correct number of significant figures.
4. (8 points) Copper can be drawn into thin wires. How many meters of 34 gauge wire (diameter = 6.304 x 10-3 in) can be produced from the 8.01 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.)
5. (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.
6. (6 points) Complete the following double displacement reaction with balanced molecular, total ionic, and net ionic equations.

Fe(NO3)2*(aq)* + H3PO4*(aq)* 🡪

3 Fe(NO3)2*(aq)* + 2 H3PO4*(aq)* 🡪 Fe3(PO4)2*(s)* + 6 HNO3*(aq)*

Balanced total ionic equation

3 Fe+2*(aq)* + 6 NO3-1*(aq)* + 2 H3PO4*(aq)* 🡪 Fe3(PO4)2*(s)* + 6 H+1*(aq)* + 6 NO3-1*(aq)*

Balanced net ionic equation

3 Fe+2*(aq)* + 2 H3PO4*(aq)* 🡪 Fe3(PO4)2*(s)* + 6 H+1*(aq)*

1. (4 points) Balance the following redox half reaction that occurs in basic solution

SO2Cl2  + H2O + 2 e-1🡪 SO3-2 + 2 Cl-1 + 2 H+1

2 H+1 + 2 OH-1 🡪 2 H2O

SO2Cl2 + 2 OH-1 + 2 e-1 🡪 SO3-2 + 2 Cl-1 + H2O

Is this an oxidation or a reduction?

reduction

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

S2O3-2 + OCl-1 🡪 Cl-1 + S4O6-2

1st half reaction

2 S2O3-2 🡪 S4O6-2 + 2 e-1

2nd half reaction

OCl-1 + 2 H+1 + 2 e-1🡪 Cl-1 + H2O

overall reaction in acid

2 S2O3-2 + OCl-1 + 2 H+1 🡪 S4O6-2 + Cl-1+ H2O

1. (8 points) When 6.853 mg of a sex hormone containing C, H, and O was burned in a combustion analysis, 19.73 mg of CO2 and 6.391 mg of H2O were obtained. What is the empirical formula of the compound?

(

(10.43% H)

1. (5 points) How many grams of copper are in 50.0 mL of a 25.4% solution of copper (II) chloride with a density of 1.284 g/mL?
2. (10 points) Phencyclidine or angle dust has a molecular formula C17H25N. Answer the following questions regarding phencyclidine.
   1. Calculate the molar mass of phencyclidine.
   2. Calculate the number of moles of carbon in 4.29 moles of phencyclidine.
   3. Calculate the number of molecules of phencyclidine that contains 675 atoms of hydrogen.
   4. Calculate the mass of phencyclidine that contains 5.922 x 1024 atoms of carbon.
   5. Calculate the mass in grams of one molecule of phencyclidine.
3. (15 points) You mix 527.0 mL of 0.2754 M sodium carbonate with 400.0 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=0.1337mol |  |  |  |  |
|  | 3 Na2CO4(aq) | + | 2 CrCl3(aq) | 🡪 | 6 NaCl(aq) | + | Cr2(CO3)3(s) |
| I | 0.1451 mol |  | 0.2674 mol |  | 0 mol |  | 0 mol |
|  | -3x |  | -2x |  | +6x |  | + x |
| E | 0.1451 – 3x |  | 0.1671-2x |  | 6x |  | 1x |
|  | =0.1451-3(.0484)  =0 mol |  | =0.2674-2(.0484)  =0.1707mol |  | =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] = 0.3133M

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

Moles Cr+3 = 0.1707 mol [Cr+3] = 0.1841 M

Moles Cl-1 = 0.8025 mol [Cl-1] = 0.8637 M