Chemistry 141 Name

Dr. Cary Willard

Exam 1a September 19, 2012

Multiple Choice (26 points)

Page 5 (15 points)

Page 6 (11 points)

Page 7 (10 points)

Page 8 (24 points)

Page 9 (5 points)

Page 10 (10 points)

Total (101 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

1 mi = 5280 ft

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) |  | |  |  |  |  |  |  |  |

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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

Multiple Choice (26 points) – Give the best answer for each of the following questions.

1. Which one of the following statements about temperature scales is **false**?
   1. The freezing point of water on the Celsius scale is 0 degrees.
   2. The boiling point of water on the Fahrenheit scale is 212 degrees.
   3. The Celsius degree is smaller than the Fahrenheit degree.
   4. All temperatures on the Kelvin scale are positive numbers.
   5. All of the above statements are true.
2. 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 6.27 cm, what can be said about the student's results?
   1. It is precise but not accurate.
   2. It is neither precise nor accurate.
   3. It is accurate and precise.
   4. It is accurate but not precise.
   5. Unable to determine from the information given.



1. To the correct number of significant figures, what is the temperature reading on the Celsius thermometer on the right?
   1. 21oC
   2. 21.70 oC
   3. 21.7 oC
   4. 22 oC
   5. 22.5 oC
2. Which of the following is a part of Dalton's atomic theory?
   1. Atoms break down during radioactive decay.
   2. Isotopes of the same element have different masses.
   3. Atoms contain protons, neutrons, and electrons.
   4. Atoms are rearranged but not changed during a chemical reaction.
   5. All of the above are part of Dalton’s atomic theory.
3. Boron-9 can be represented as
4. In which set do all elements tend to form cations in binary ionic compounds?
   1. Li, B, O
   2. O, F, Cl
   3. N, As, Bi
   4. Na, K, P
   5. Mg, Cr, Pb
5. What is the empirical formula for C4H10O2?
   1. C2H5O
   2. CHO
   3. C2H4O
   4. CHO2
   5. CH2O
6. The name of the compound C5H12 is
   1. Butane
   2. Ethane
   3. Pentane
   4. Fifthane
   5. Heptane
7. Which of the following exists as a diatomic molecule?
   1. N
   2. C
   3. P
   4. Na
   5. Ne
8. Which statement about elemental analysis by combustion is **not** correct?
   1. Hydrogen is determined from the amount of H2O formed.
   2. Carbon is determined from the amount of CO2 formed.
   3. Only carbon and hydrogen can be determined directly from CO2 and H2O.
   4. Oxygen is determined from the amount of H2O and CO2 formed.
   5. All of the above are correct.
9. Which of the following statements concerning ionic compounds is **true**?
   1. The chemical formula for an ionic compound must show a nonzero net charge.
   2. Ionic compounds do not contain any covalent bonds.
   3. Ionic compounds contain the same number of positive ions as negative ions.
   4. Essentially all ionic compounds are solids at room temperature and pressure.
   5. Ionic compounds must contain a metal atom.
10. The organic solvent dichlorobenzene, C6H4Cl2 , contains
    1. C4+, H+, and Cl− ions
    2. C6H4Cl2 molecules.
    3. C6H4+2 ions and Cl−2 ions
    4. C4+, H4+4, and Cl22- ions.
    5. None of the above
11. Choose the statement below that is TRUE.
    1. The term "strong electrolyte" means that the substance is extremely reactive.
    2. A strong acid solution consists of only partially ionized acid molecules.
    3. The term "weak electrolyte" means that the substance is inert.
    4. A molecular compound that does not ionize in solution is considered a strong electrolyte.
    5. A weak acid solution consists of mostly nonionized acid molecules.

Problems

1. (5 points) Give the IUPAC name for the following compounds
   1. (NH4)3P ammonium phosphide
   2. Cu3PO4 copper(I) phosphate or cuprous phosphate
   3. P2O7 diphosphorous heptoxide
   4. Ag2O silver oxide
   5. KMnO4 potassium permanganate
2. (5 points) Write the correct formula for each of the following compounds
   1. sodium acetate NaC2H3O2
   2. trisulfur pentachloride S3Cl5
   3. zinc perchlorate Zn(ClO4)2
   4. ferric hydroxide Fe(OH)3
   5. sulfuric acid H2SO4
3. (5 points) The density of a 45.0% by mass ethylene glycol (C2H6O2) solution in water is 1.08 g/mL. Find the molarity of the solution.
4. (5 points) Antarctica, almost completely covered in ice, has an area of 5,500,000 mi2 with an average height of 6500 ft. Without the ice, the height would be only 1500 ft. Estimate the mass of this ice in kilograms. The density of ice is 0.917 g/cm3.
5. (6 points) The volumes of a 20.00 mL pipet and a 50.0 mL graduated cylinder were determined by weighing the amount of water they delivered (pipet and cylinder). The pertinent information is given in the table; all volumes are in mL. For each device rate the **precision** and **accuracy** as good or poor . The balance used for the measurements was calibrated and thereby known to be accurate. Justify your choices.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Item** | **rated volume** | **Rated uncertainty** | **number of trials** | **average value** | **s** | **precision** | **accuracy** |
| Pipet | 20.00 | 0.05 | 4 | 19.53 | 0.03 | good | poor |
| The accuracy is poor because the average value is not within the rated uncertainty, but the precision is good because the standard deviation is less than the rated deviation. | | | | | | | |
| Cylinder | 50.0 | 0.3 | 12 | 50.2 | 0.7 | poor | good |
| The accuracy is good because the average value is within the rated uncertainty, but the precision is poor because the standard deviation is greater than the rated deviation. | | | | | | | |

1. (10 points) Complete and balance the following two doublé displacement reactions. Write the total and net ionic equations for each reaction.
   1. Mo(C2H3O2)2*(aq)* + NH3*(aq)* (You may want to add wáter to this equation)

Conventional

Mo(C2H3O2)2*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)* → Mo(OH)2*(s)* + 2 NH4C2H3O2(aq)

Net ionic

Mo2+*(aq)* + 2 C2H3O2−*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)* → Mo(OH)2*(s)* + 2 NH4+*(aq)* + 2 C2H3O2−*(aq)*

*Total ionic*

Mo2+*(aq)* + 2 NH3*(aq)* + 2 H2O*(l)* → Mo(OH)2*(s)* + 2 NH4+*(aq)*

* 1. K2C2O4(aq) + HClO4(aq) 🡪

Conventional

K2C2O4(aq) + 2 HClO4(aq) 🡪 H2C2O4(aq) + 2 KClO4(aq)

Total ionic

2 K+(aq) + C2O42−(aq) + 2 H+(aq) + 2 ClO4−(aq) 🡪 H2C2O4(aq) + 2K+(aq) + 2 ClO4−(aq)

Net ionic

C2O42−(aq) + 2 H+(aq) 🡪 H2C2O4(aq)

1. (24 points) A sample of norzoanthamine, an alkaloid thought to prevent bone loss which is synthesized by sea anemones, has a molecular formula of C29H39NO5.
   1. Calculate the molar mass of norzoanthamine.
   2. Calculate the mass in kg of 8.31 moles of norzoanthamine.
   3. Calculate the millimoles of norzoanthamine in 45.0 g of norzoanthamine.
   4. Calculate the mass of norzoanthamine that contains 61.0 g of oxygen.
   5. Calculate the moles of hydrogen in the sample from part d.
   6. Calculate the number of atoms of carbon in the sample from part d.
   7. Norzoanthamine is not soluble in water, but is slightly soluble in hexane. If 5.04 g of norzoanthamine is dissolved in enough hexane to make 50.0 mL of solution, what is the molarity of the solution?
   8. If a 10.0 mL aliquot of the solution in part d is diluted to 250.0 mL to be injected into NMR scanner, what is the concentration of the norzoanthamine?
2. (5 points) Toilet bowl cleaners often contain hydrochloric acid, which dissolves the calcium carbonate deposits that accumulate within a toilet bowl. A 25.00 mL sample of a toilet bowl cleaner is titrated with 39.42 mL of a 0.253 M solution of potassium hydroxide. What is the molarity of hydrochloric acid in the toilet bowl cleaner?
3. (10 points) Chlorine dioxide, ClO2, has been used as a disinfectant in air-conditioning systems. It reacts with water according to the equation 6 ClO2 + 3 H2O 🡪 5 HClO3 + HCl. If 235.0 g of ClO2 is mixed with 38.00 g of H2O, calculate
   1. The theoretical mass of HClO3 produced.
   2. The mol of ClO2 and H2O remaining.

0 mol ClO2 and 0.366 mol H2O remain.

* 1. The percent yield if 193.5 g of HClO3 are produced.

6 ClO2 + 3 H2O 🡪 5 HClO3 + HCl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | x=0.5807 | x=0.7027 |  |  |
| I | 3.484 mol | 2.108 mol | 0 mol | 0 mol |
| Δ | -6x | -3x | +5x | +x |
| E | 3.187-6x  =0 mol | 2.108-3x  =2.108-3(0.5807)  =0.366 mol | 5x  =5(.5807)  =2.904 mol | x  =0.5807 mol |