Chemistry 141 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Exam 1B February 25, 2014

Multiple Choice (30 points)

Page 3 (21 points)

Page 4 (30 points)

Page 5 (21 points)

Page 6 (14 points)

Total (116 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 mile =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) |  | |  |  |  |  |  |  |  |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 I – Multiple Choice (30 points)

1. Which one of the following statements about temperature scales is false?
   1. The Celsius degree is smaller than the Fahrenheit degree.
   2. The freezing point of water on the Celsius scale is 0 degrees.
   3. The boiling point of water on the Fahrenheit scale is 212 degrees.
   4. All temperatures on the Kelvin scale are positive numbers
   5. All the statements are true
2. Which of the following items is not an intensive property?
3. Solid cupric hydroxide is blue colored.
4. The melting point of aluminum metal is 933 K.
5. A chemical reaction requires 3.00 g of oxygen
6. The density of helium at 25 °C is 1.64 x 10-4 g/cm3
7. All of the above
8. Which of the following statements is true?
9. A scientific law is fact.
10. Once a theory is constructed, it is considered fact.
11. A hypothesis is speculation that is difficult to test.
12. An observation explains why nature does something.
13. A scientific law summarizes a series of related observations
14. Which are isotopes? An atom that has an atomic number of 34 and a mass number of 76 is an isotope of an atom that has
    1. 42 neutrons and 34 protons.
    2. An atomic number of 34 and a mass number of 80.
    3. An atomic number of 32 and a mass number of 76.
    4. 42 protons and 34 neutrons.
    5. None are isotopes
15. A sample of element X contains 90% X-35 atoms 8.0% X-37 atoms, and 2.0% X-38 atoms. The average atomic mass will be closest to which value?

a. 39 b. 38 c. 37 d. 36 e. 35

1. The standard deviation provides information about
2. the proximity of a value to the “true value”
3. The accuracy of your data.
4. The scatter of a dataset around a mean.
5. the presence of systematic errors in your measurement
6. none of the above
7. Which of the following solutes in water would give a bright light with the conductivity apparatus used in lab?
8. Nitrous acid
9. Magnesium hydroxide
10. Acetic acid
11. Ammonium hydroxide
12. None of the above
13. All of the following statements 57.1 g of octane are true, C8H18, EXCEPT
14. 57.1 g is 0.500 mol of octane.
15. The compound has 84.1% C by weight
16. The empirical formula of the compound is C4H9
17. 57.1 g of octane contains 28.0 g of hydrogen atoms
18. All the statements are true
19. How many protons, neutrons, and electrons are in a 51Cr3+ ion?
20. p = 24, n = 27, e = 21
21. p = 24, n = 27, e = 27
22. p = 27, n = 24, e = 21
23. p = 24, n = 51, e = 21
24. p = 51, n = 21, e = 27
25. The average mass of a carbon atom is 12.011. If you were able to select a single carbon atom randomly from a naturally occurring sample, the chances that you would select one with a mass of 12.011 is
26. 0% b) 0.011% c) about 12% d) 12.011 % e) greater than 50%
27. 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 are rearranged but not changed during a chemical reaction.
    4. Atoms contain protons, neutrons, and electrons.
    5. None of these are part of Dalton's atomic theory
28. Which one of the following statements about balanced equations is false? In a balanced reaction
    1. Net charge must be balanced on both sides of the reaction arrow.
    2. Mass must be conserved.
    3. Atoms must be balanced on both sides of the reaction arrow.
    4. Molecules must be balanced on both sides of the reaction arrow.
29. 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.
    5. All are true
30. What reagent could be used to separate Br- from NO3- when added to an aqueous solution containing both?
    1. NaI (*aq)* b) AgNO3 (*aq)*  c) CuSO4 (*aq)*  d) Ba(OH)2 (*aq)* e) NH4Cl (aq)
31. Which statement about elemental analysis by combustion is not correct?
    1. Only carbon and hydrogen can be determined directly from CO2 and H2O.
    2. Oxygen is determined from the amount of H2O formed.
    3. Hydrogen is determined from the amount of H2O formed.
    4. Carbon is determined from the amount of CO2 formed.
    5. All statements are correct

Part II: Short Answer (86 points)

|  |  |  |  |
| --- | --- | --- | --- |
| 1. (5 points) Give the IUPAC name for the following compounds | | 1. (5 points)Write the correct formula for each of the following compounds | |
| Co2(Cr2O7)3 |  | Sulfurous acid |  |
| Si3F7 |  | zinc nitride |  |
| (NH4)3BO3 |  | Cupric hypochlorite |  |
| Cd(MnO4)2 |  | zinc phosphite |  |
| H2Se (aq) |  | sulfur hexachloride |  |

1. (5 points) Antarctica, almost completely covered in ice, has an area of 6,500,000 mi2 with an average height of 8500 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.
2. (6 points) Write a balanced net ionic equation for the reaction that occurs in each of the following cases. Assume that all soluble reactants are added in the form of aqueous solutions. Indicate gases and precipitates that are formed, as well as insoluble solid reactants. If no reaction occurs, then write “NO RXN” and do not write a balanced equation

\_\_\_\_NiSO4*(aq)* + \_\_\_ NH3*(aq)* 🡪

* 1. Balanced total ionic equation
  2. Balanced net ionic equation

1. (12 points): My dogs (Bubba and Baby) were doing a conductivity experiment. Their observations are below. The dogs can’t interpret the results. Complete the following table

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Substance** | **Bond Type**  **(Polar covalent, Ionic)** | **Conductivity** | **Ions (None, Few, Many)** | **Major species present in solution** | **Minor species in solution** |
| CH3CO2H (aq) |  | Poor |  |  |  |
| KClO3 (s) |  | None |  |  |  |
| 0.1 M HCl |  | Good |  |  |  |

1. (18 points) The molecule responsible for the hot pungent component of ginger root is zingerone, C11H14O3.
2. Calculate the molecular weight of zigerone
3. Calculate the mass of zigerone that contains 7.863 x 1025 atoms of carbon.
4. Calculate the number of moles of hydrogen in a sample of zigerone containing 4.38 moles of oxygen.
5. Calculate the mass in grams of one molecule of zigerone.
6. A solution of 40.00% zigerone has a density of 0.706 g/cm3. What is the molarity of the solution?
7. If a 10.0 mL aliquot of the solution in part e. is diluted to 250.0 mL to be injected into NMR scanner, what is the concentration of the zingerone?
8. (8 points)A 2.00 mg sample of a compound, which contains only carbon, hydrogen and oxygen, is burned **completely** in oxygen. The products of combustion are 4.881 mg of CO2 and 2.002 mg of H2O. The molecular mass as determined by mass spectrometry is 144.2 g/mol. What is the empirical and molecular formula of the compound?
9. (7 points) For the following balanced redox reaction answer the following questions

12 NaOH (aq) + 4 As (s) + 3 NaClO3 (aq) 🡪 4 Na3AsO3(aq) + 3 NaClO (aq) + 6 H2O

* 1. What is the oxidation state of Cl in NaClO3 (aq) \_\_\_\_\_\_\_\_\_\_\_\_\_
  2. What is the oxidation state of As in As (s)? \_\_\_\_\_\_\_\_\_\_\_\_\_
  3. What is the element that is oxidized? \_\_\_\_\_\_\_\_\_\_\_\_\_
  4. What is the element that is reduced? \_\_\_\_\_\_\_\_\_\_\_\_\_
  5. What is the oxidizing agent? \_\_\_\_\_\_\_\_\_\_\_\_\_
  6. What is the reducing agent? \_\_\_\_\_\_\_\_\_\_\_\_\_
  7. How many electrons are transferred in the reaction as it is balanced? \_\_\_\_\_\_\_\_\_\_\_\_\_

1. (6 points) Nitrogen fixation in the root nodules of peas and other legumes occurs with a reaction involving a molybdenum containing enzyme named nitrogenase. This enzyme contains two Mo atoms per molecule and is 0.0947% Mo by mass. What is the molar mass of the enzyme (enzyme molar mass are quite large)?
2. (14 points) You mix 427.0 mL of 0.2754 M sodium carbonate with 400.0 mL of 0.6684 M iron(III) bromide. Write the reaction and determine the number of grams of iron(III) carbonate produced, and the final concentration of all ions in the solution using an I, , E diagram. .

Balanced chemical equation

\_\_ Na2CO3*(aq)* + \_\_\_ FeBr3*(aq)* 🡪 \_\_\_ NaBr*(aq)* + \_\_\_Fe2(CO3)3*(s)*

Moles Fe2(CO3)3 produced Mass Fe2(CO3)3 produced

[Na+1] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [CO3-2] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[Fe+3] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ [Br-1] = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_