Chemistry 115 Name

Dr. Cary Willard

Exam 4b May 22, 2014

Multiple Choice (30 points)

Page 4 (18 points)

Page 5 (22 points)

Page 6 (16 points)

Page 7 (14 points)

Total (100 points)

All work must be shown to receive credit. Give all answers to the correct number of significant figures

Be careful – there may be data provided that you do not need. Sometimes that data is just there to confuse you!

Avogadros number = 6.022 x 1023 /mol

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. In a system at equilibrium between the liquid and gas phases
   1. The rate at which particles change from gas to liquid exceeds the rate at which they change from liquid to gas.
   2. The rate at which particles change from liquid to gas exceeds the rate at which they change from gas to liquid.
   3. The rate at which particles change from gas to liquid equals the rate at which they change from liquid to gas.
   4. Particles stop changing phase.
2. Which has the lowest vapor pressure?
   1. 5 mL of water at 323 K
   2. 10 mL of water at 298 K
   3. 50 mL of water at 293 K
   4. 25 mL of water at 283 K
3. The normal boiling point of a liquid is the temperature at which its vapor pressure equals
   1. 100 torr
   2. 337 torr
   3. 373 torr
   4. 760 torr
4. Which substance contains molecules that will not form hydrogen bonds?
   1. Hydrogen
   2. Hydrogen fluoride
   3. Water
   4. Ammonia
5. Which of the following properties of water is not affected by hydrogen bonding?
   1. Boiling point
   2. Molar mass
   3. Freezing point
   4. Vapor pressure
6. As temperature increases, the solubility of a gas in water
   1. Decreases
   2. Increases
   3. Remains the same
   4. Depends on the gas, some increase in solubility and others decrease
7. One liter of 2.0 M KCl solution and two liters of 1.0 M KCl solution have the same
   1. Density
   2. Concentration
   3. Moles of solute
   4. Volume
8. In basic solutions
   1. Litmus is blue and phenolphthalein is colorless
   2. Litmus is blue and phenolphthalein is red
   3. Litmus is red and phenolphthalein is colorless
   4. Litmus is red and phenolphthalein is red
9. Which is the pH of a solution in which the concentration of hydrogen ion is greater than the concentration of hydroxide ion?
   1. 12
   2. 3
   3. 9
   4. 7
10. Which hydrocarbon series contains a double covalent bond between carbon atoms?
    1. Alkanes
    2. Aromatics
    3. Alkynes
    4. Alkenes
11. Which has the greatest number of isomers?
    1. C4H10
    2. C3H8
    3. C2H6
    4. CH4
12. A molecule of propane and a molecule of propene have the same
    1. General formula
    2. Molecular formula
    3. Structural formula
    4. Number of carbon atoms
13. What is the maximum number of covalent bonds a carbon atom can form?
    1. Four
    2. Three
    3. Two
    4. One
14. The four major classes of molecules upon which all life depends are
    1. Carbohydrates, ethers, proteins, and nucleic acids
    2. Carbohydrates, alcohols, proteins, and nucleic acids
    3. Alcohols, lipids, proteins, and nucleic acids
    4. Carbohydrates, lipids, proteins, and nucleic acids
15. Fats and oils are
    1. Carbohydrates
    2. Lipids
    3. Proteins
    4. Hydrocarbons

Problems (70 points)

1. (6 points) Isobutyl propionate, the ester responsible for the flavor of rum has a boiling point of 137oC and octyl acetate, the ester responsible for the flavor of oranges has a boiling point of 210oC. Based on this information, which compound would you expect to have the higher viscosity? Explain how you came to this conclusion.

The compound with the higher boiling point should have the stronger intermolecular forces and thus the higher viscosity.

1. (8 points) Many people like to make their own hand lotions because it can be less expensive than buying it and they have the ability to add only the fragrances that they like. A recipe for hand lotion calls for mixing 235 g of water (H20) with 296 g of glycerin (C3H8O3). This recipe makes a total of 550. mL of hand lotion.
   1. What is the mass percent of glycerin in the hand lotion?
   2. What is the molarity of glycerin in the hand lotion?
2. (4 points) If 25.00 mL of a 5.293 M solution of methanol is diluted to a final volume of 3.250 L, what is the concentration of methanol in the final solution?
3. (4 points) Calculate the volume (in mL) of a 0.7322 M K3PO4 required to supply 35.2 g of potassium phosphate for a reaction.
4. (6 points) A 38.20% solution of calcium nitrate, has a density of 1.624 g/mL.
   1. How many moles of calcium nitrate are there in every 100.0 grams of solution?
   2. What is the volume in liters of 100.0 g of solution?
   3. What is the molarity of calcium nitrate in the solution?
5. (3 points) What is the conjugate acid of HS−1?

H2S

1. (3 points) What is the conjugate base of H3C6H5O7?

H2C6H5O7−

1. (6 points) Write an equation to illustrate the acid-base reactions that will take place between H2CO3 and NH3. Identify the acids and bases.
2. (8 points) Fill in the chart below: (give concentrations to 3 sig figs and pH and pOH to 3 places after the decimal.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| [H3O+] | [OH-1] | pH | pOH | Acidic or basic |
| 2.58 x 10-11 M | 3.87 x 10-4 M | 10.587 | 3.412 | basic |
| 4.63 x 10-9 M | 2.16 x 10-6 M | 8.334 | 5.666 | basic |

1. (8 points) A 35.00 mL aliquot of a glutamic acid solution is titrated with 41.85 mL of a 0.3721 M solution of sodium hydroxide (40.00 g/mol). What is the concentration of glutamic acid(H2C5H7NO4, 147.13 g/mol) in the solution?

|  |  |
| --- | --- |
| Moles NaOH used to titrate sample | 0.01557 mol |
| Moles glutamic acid in the sample | 0.007786 mol |
| Molarity glutamic acid | 0.2224 M |

1. (3 points) Draw an example of an amine. (Show the structural or condensed structural formula.)



1. (3 points) Draw an example of an alkyne. (Show the structural or condensed structural formula.)



1. (6 points) What is the correct name for the compounds below?

 

3,4,6-trimethyl octane 3-heptene

1. (2 points) Give one function of proteins in living organisms.

Catalysis