Chemistry 115 Name key

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Exam 4a December 9, 2013

Multiple Choice (30 points)

Page 4 (18 points)

Page 5 (18 points)

Page 6 (16 points)

Page 7 (18 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. Which phase change is condensation?
   1. Liquid to gas
   2. Solid to liquid
   3. Solid to gas
   4. Gas to liquid
2. Which has the highest vapor pressure?
   1. 5 mL of water at 323 K
   2. 25 mL of water at 283 K
   3. 10 mL of water at 298 K
   4. 50 mL of water at 293 K
3. A volatile substance
   1. Melts with great difficulty
   2. Freezes readily
   3. Condenses easily
   4. Evaporates readily
4. The normal boiling point of a liquid is the temperature at which its vapor pressure equals
   1. 760 torr
   2. 100 torr
   3. 337 torr
   4. 373 torr
5. The high boiling point of water is due to
   1. Hydrogen bonds
   2. Polar covalent bonds
   3. Nonpolar covalent bonds
   4. Ionic bonds
6. At which temperature would NH3 gas be most soluble?
   1. 293 K
   2. 303 K
   3. 283 K
   4. 313 K
7. At which pressure would nitrogen gas be most soluble?
   1. 1.0 atm
   2. 1.5 atm
   3. 2.0 atm
   4. 2.5 atm
8. Which phase of matter can act as a solvent?
   1. Solid
   2. Liquid
   3. Gas
   4. All the above
9. Liquids which are capable of mixing and forming a solution are
   1. Unsaturated
   2. Dilute
   3. Miscible
   4. Immiscible
10. Which is the hydroxide ion?
    1. OH -1
    2. OH2 -1
    3. H +1
    4. H3O +1
11. Which pH is most acidic?
    1. 14
    2. 9
    3. 7
    4. 3
12. Which hydrocarbon series is saturated?
    1. Alkenes
    2. Alkanes
    3. Alkynes
    4. Aromatics
13. Two or more different compounds with the same molecular formula are
    1. Isotopes
    2. Hypermeres
    3. Hypertopes
    4. Isomers
14. Proteins are polymers of
    1. Amino acids
    2. Glucose
    3. Glycerol
    4. Amylose
15. The two strands of the double stranded helix of DNA are held together by
    1. Ionic bonds
    2. Peptide bonds
    3. Hydrogen bonds
    4. Phosphate ester bonds

Problems (70 points)

1. (6 points) Define the term boiling point. How does the boiling point of a liquid change as intermolecular forces become stronger? Explain using kinetic molecular theory (KMT) how differences in intermolecular forces affect boiling point.

Boiling point is the temperature where the liquid is converted into a vapor. The normal boiling point is the temperature where this transition occurs at atmospheric pressure.

As intermolecular forces become stronger, the vapor pressure of a liquid decreases.

This is because stronger intermolecular forces cause the molecules to be more strongly attracted to each other resulting a decrease in the number of molecules which are able to escape from the liqud.

1. (8 points) A pot of chai tea has a volume of 600. mL, a mass of 618. g, and contains 866 mg of cinnamonaldehyde (C9H8O), the principle component of cinnamon.
   1. What is the molarity of cinnamonaldehyde in the tea?
   2. What is the mass percent of cinnamonaldehyde in the tea?
2. (4 points) How many mL of 12.63 M acetic acid are required to make 25.00 L of vinegar with an acetic acid concentration of 0.3655 M?
3. (6 points) A 2.742 M solution of copper(II) chloride, CuCl2, has a density of 1.132 g/mL.
   1. How many grams of cupric chloride are there in every L of solution?
   2. What is the mass in grams of exactly 1 L of solution?
   3. What is the mass percent of copper(II) chloride in the solution?
4. (3 points) What is the conjugate acid of NH3?

NH4+

1. (3 points) What is the conjugate base of H2C2O4?

HC2O4−

1. (6 points) Write an equation to illustrate the acid-base reactions that will take place between H3PO3 and OH-. 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 |
| 3.09 x 10-11 M | 3.24 x 10-4 M | 10.511 | 3.490 | basic |
| 1.90 x 10-10 M | 5.26 x 10-5 M | 9.721 | 4.279 | basic |

1. (8 points) A 25.00 mL aliquot of an oxalic acid solution is titrated with 41.66 mL of a 0.5377 M solution of sodium hydroxide (40.00 g/mol). What is the concentration of oxalic acid(H2C2O4, 90.03 g/mol) in the solution?

|  |  |
| --- | --- |
| Moles NaOH used to titrate sample | 0.01702 mol |
| Moles oxalic acid in the sample | 0.008510 mol |
| Molarity oxalic acid | 0.3404 M |

1. (3 points) What are dispersion forces? Which has greater dispersion forces, C3H8 or C9H20? Justify your answer.

Dispersion forces are intermolecular forces between molecules or atoms due to the formation of temporary instantaneous dipoles. These dipoles act like little magnets attracting the particles together.

C9H20 has greater dispersion forces because it has a higher molar mass and more electrons. The more electrons a molecule has the more polarizable it is meaning that it is more likely for the electrons to be unevenly distributed causing a temporary dipole to form.

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



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



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

 

3,4-dimethyl octane 2-heptene

1. (3 points) What is the difference between saturated and unsaturated fats/oils? (give both structural and physical property differences)

Saturated fats have all single bonds and form solid fats. Unsaturated fats contain double bonds and form liquid oils.