Chemistry 115 Name

Dr. Cary Willard

Exam 3B November 9, 2009

|  |  |  |
| --- | --- | --- |
|  | Points Earned | Points Possible |
| Part 1  multiple choice |  | 30 |
| Page 2 |  | 14 |
| Page 3 |  | 18 |
| Page 4 |  | 18 |
| Page 5 |  | 20 |
|  |  |  |
| Total |  | 100 |

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

NA = 6.022 x 1023/mol

PV=nRT

R=0.0821 L atm/mol K= 62.4 L torr.mol K

760 torr = 760 mm Hg = 1.00 atm = 101 kPa = 14.7 psi = 29.9 in Hg

K = oC+273.16

0oC=273.16 K

Part 1 – Multiple Choice (30 points)

1. What is the maximum number of electrons that can occupy the 3p sublevel?
   1. 2
   2. 10
   3. 6
   4. 18
2. How many orbitals are contained in the 3d sublevel?
   1. 5
   2. 7
   3. 10
   4. 2
3. A bond that is principally covalent will form between
   1. Calcium and oxygen
   2. Sulfur and oxygen
   3. Rubidium and chlorine
   4. Lithium and chlorine
4. What is the number of valence electrons in a halogen?
   1. 8
   2. 2
   3. 9
   4. 7
5. Atoms of which two elements in the ground state contain the same number of valence electrons?
   1. Al and Si
   2. Al and Zn
   3. Al and B
   4. Al and Ge
6. When potassium fluoride forms from a potassium atom and a fluorine atom
   1. A proton is transferred from the potassium atom to the fluorine atom
   2. An electron is transferred from the potassium atom to the fluorine atom
   3. A proton is transferred from the fluorine atom to the potassium atom
   4. An electron is transferred from the fluorine atom to the potassium atom
7. A Cl-1 ion has an electron configuration isoelectronic with an atom of
   1. Neon
   2. Krypton
   3. Argon
   4. Xenon
8. Which type of chemical bond involves the unequal sharing of electrons?
   1. Ionic
   2. Nonpolar covalent
   3. Polar covalent
9. How many valence electrons are present in the element with the following ground state electron configuration?

1s2 2s2 2p3

* 1. 5
  2. 2
  3. 7
  4. 3

1. Which series is ranked in order of increasing electronegativity?
   1. O, S, Se, Te
   2. Cl, S, P, Si
   3. Sr, Sn, N, O
   4. C, Si, P, Se
2. At STP, 3.00 L of nitrogen gas contains the same number of molecules as
   1. 1.00 L of nitrogen gas
   2. 3.00 L of chlorine gas
   3. 4.00 L of hydrogen gas
   4. 2.00 L of oxygen gas
3. Which atom has the largest radius?
   1. Te
   2. O
   3. S
   4. Se
4. Which of the following has a volume that consists of mostly empty space?
   1. I2(s)
   2. F2(g)
   3. Na(s)
   4. Br2(l)
5. A mixture of gases consists of helium at a partial pressure of 500. torr, neon at a partial pressure of 400. torr, and argon at a partial pressure of 300. torr. What is the total pressure of this mixture of gases?
   1. 760. torr
   2. 1500 torr
   3. 500. torr
   4. 1200. torr
6. As the temperature of a gas sample increases, the number of molecules and volume remaining constant, the pressure exerted by the gas
   1. Decreases
   2. Increases
   3. Remains the same
   4. Unable to determine

**Part 2 –Problems and Questions (70 points)**

1. (4 points) Write the complete electron configuration for chlorine.
2. (6 points) Write the shorthand electron configuration for technetium (Tc).

Write the electron configuration of a Tc+2 ion.

1. (4 points) Why is there such a large increase in the ionization energy required to remove the second electron from a sodium atom as opposed to the first? (IE # 1 =496 kJ/mol IE #2 = 4565 kJ/mol)
2. (4 points) Rank the following elements in order of increasing ionization energy. Si, S, In, Sn

\_\_\_\_\_\_\_<\_\_\_\_\_\_\_<\_\_\_\_\_\_\_<\_\_\_\_\_\_\_

1. (4 points) Why are only valence electrons represented in a Lewis structure?
2. (10 points) Draw a Lewis electron dot structure for the following atoms/molecules. Be sure to show all bonds and lone pairs.
   1. O
   2. NCl3 (N is the central atom)
   3. CN-1
3. (6 points) Tell the orbital and molecular geometry of the central atom(\*)for each of the following structures.

|  |  |  |
| --- | --- | --- |
|  | Orbital geometry | Molecular geometry |
|  |  |  |
|  |  |  |
|  |  |  |

1. (4 points) If the pressure of hydrogen gas in a cylinder is 2.85 atm, what is the pressure in torr?
2. (4 points) A balloon is filled with helium gas at a pressure of 217 torr. Its volume is 6.74 L. What will the new pressure be if the balloon is compressed to a volume of 3.58 L?
3. (4 points) An aerosol can contains nitrogen at a pressure of 8.42 atm in a 53oC room. What will the new pressure of nitrogen in the can be if it is left in a walk-in freezer where the temperature is -12oC?
4. (4 points) Explain using kinetic theory why the pressure of a gas increases when the temperature increases.
5. (5 points) If 65.2 grams of carbon dioxide are introduced into a 12.0 L container at 3.99 atm, what will its temperature be (in oC)?
6. (7 points) Calculate the volume of one mole of Argon gas at 35oC and 4.35 atm pressure.

What is its density?

1. (4 points) Calculate the volume of water, H2O, that can be produced by the reaction of 7.33 L of ammonia gas (NH3) reacting with excel oxygen gas at 25oC and 470 torr.

5 O2(g) + 4 NH3(g) 🡪 4 NO(g) + 6 H2O(g)

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) |