Chemistry 115 Name

Dr. Cary Willard

Exam 2a October 13, 2010

 Multiple Choice (30 points)

 Page 5 (24 points)

 Page 6 (26 points)

 Page 6 (20 points)

 Total (100 points)

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

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)

Exam 1 multiple choice questions

1. Atomic emission spectra are due to electrons
	1. being removed from an atom.
	2. in an atom rising from one energy level to a higher one.
	3. being added to an atom.
	4. changing state from solid to liquid.
	5. in an atom dropping from one energy level to a lower one.
2. According to the Pauli exclusion principle, any orbital can hold at most *\_\_\_\_\_\_\_\_* electrons.
	1. 2
	2. 6
	3. 8
	4. 18
	5. 10
3. The electron configuration of an atom shows
	1. the number of isotopes possible.
	2. a description of the shape of each electron energy level.
	3. the number of electrons in each electron energy level.
	4. a diagram of an atomic nucleus.
	5. the maximum number of electrons each electron energy level can hold.
4. The atomic radius of potassium is smaller than the atomic radius of *\_\_\_\_\_\_\_\_.*
	1. lithium
	2. cesium
	3. fluorine
	4. hydrogen
	5. sodium
5. Valence electrons are electrons located
	1. in the outermost energy level of an atom.
	2. in the nucleus of an atom.
	3. in the first energy level of an atom.
	4. throughout the atom.
	5. in the first three energy levels of an atom.
6. The ionization energy of chlorine is lower than the ionization energy of *\_\_\_\_\_\_\_\_.*
	1. sodium
	2. fluorine
	3. hydrogen
	4. lithium
	5. calcium
7. To form an ion, a sodium atom
	1. gains one electron.
	2. gains two electrons.
	3. loses seven electrons.
	4. loses one electron.
	5. loses two electrons.
8. An anion always
	1. has a positive charge.
	2. contains a group of two or more atoms with a positive charge.
	3. contains a metal and a nonmetal.
	4. forms covalent bonds.
	5. has a negative charge.
9. Which one of the following elements forms two or more ions with different ionic charges?
	1. K
	2. F
	3. Fe
	4. Ca
	5. O
10. A group of covalently bonded atoms that has an overall electrical charge is called a(n) \_\_\_\_\_\_\_\_.
	1. ionic compound
	2. anion
	3. cation
	4. polyatomic ion
	5. molecule
11. According to the IUPAC nomenclature system, the types of compound that use prefixes in their names are \_\_\_\_\_\_\_\_.
	1. ionic compounds
	2. ionic compounds involving transition metals
	3. covalent compounds
	4. polyatomic ions
	5. compounds that contain polyatomic ions
12. What is the name of this compound?

CH3- CH2- CH2- CH2- CH2- CH2- CH3

* 1. hexane
	2. heptane
	3. octane
	4. butane
	5. pentane
1. Avogadro's number is the number of
	1. amu in 1 mol of a substance.
	2. grams in 1 mol of a substance.
	3. moles in 6.022 × 1023 grams of an element.
	4. moles in 6.022 × 1023 amu of an element.
	5. particles in 1 mol of a substance.
2. A chemical equation is balanced when
	1. the total number of molecules is the same in reactants and products.
	2. the total number of ions is the same in reactants and products.
	3. the sum of the coefficients of the reactants is equal to the sum of the coefficients of the products.
	4. the number of atoms of each element is the same in reactants and products.
	5. the charge on each atom is the same in reactants and products.
3. The reaction of carbon dioxide to form carbon monoxide and oxygen is what type of reaction?

2CO2 (*g*) → 2CO (*g*) + O2 (*g*)

* 1. single replacement
	2. decomposition
	3. combination
	4. oxidation
	5. double replacement

Part 2 – Problems and Short Answer (70 points)

1. (3 points) What is an orbital?

An orbital is the region in space where an electron exists.

1. (3 points) Write the complete electron configuration of phosphorus.

1s2 2s2 2p6 3s2 3p3

1. (3 points) Write the shorthand electron configuration of niobium (Nb)

[Kr] 5s2 4d3

1. (5 points) Describe how atomic size changes as you move across the periodic table to the right and explain the reason for this trend.

As you move across the table to the right, the effective charge felt by the outermost electrons increases thereby pulling them closer to the nucleus and thus making the atoms smaller.

1. (4 points) Circle the element with the higher ionization energy

Magnesium or Phosphorus?

Oxygen or Tellurium?

1. (6 points) Name the following compounds
	1. MgCO3 magnesium carbonate
	2. NH4Cl ammonium chloride
	3. Li3N lithium nitride
	4. SO3 sulfur trioxide
2. (6 points) Give the correct formula for the following compounds
	1. Chromium(III) oxide Cr2O3
	2. Calcium hydroxide Ca(OH)2
	3. Diboron hexafluoride B2F6
	4. Zinc sulfide ZnS
3. (3 points) Calculate the mass of 8.35 moles of gold (Au)

$$?g Au=8.35 mol Au×\frac{196.97 g Au}{1 mol Au}=1.65 ×10^{3} g Au or 1650 g Au$$

1. (4 points) Calculate the number of atoms of gold in 3.24 moles of gold.

$$?atoms Au=3.24 mol Au×\frac{6.022×10^{23}atom Au}{1 mol Au}=1.95×10^{24}atom Au$$

1. (4 points) Calculate the molar mass of benzaldehyde (C7H6O)

$$molar mass=7\left({12.01 g}/{mol}\right)+6\left({1.008 g }/{mol}\right)+1\left({16.00 g}/{mol}\right)$$

$$=84.07+6.048+16.00$$

$$={106.12 g}/{mol}$$

1. (4 points) Calculate the number of moles of benzaldehyde in 97.3 grams of benzaldehyde.

$$?mol C\_{7}H\_{6}O=97.3 g C\_{7}H\_{6}O×\frac{1 mol C\_{7}H\_{6}O}{106.1 g C\_{7}H\_{6}O}=0.917 mol C\_{7}H\_{6}O$$

1. (5 points) Calculate the number of atoms of carbon in 5.00 g of benzaldehyde.

$$?atoms C=5.00 g C\_{7}H\_{6}O×\frac{1 mol C\_{7}H\_{6}O}{106.1 g C\_{7}H\_{6}O}×\frac{7 mol C}{1 mol C\_{7}H\_{6}O}×\frac{6.022×10^{23}atom C}{1 mol C}=1.99×10^{23}atom C$$

or

$$?atoms C=5.00 g C\_{7}H\_{6}O×\frac{1 mol C\_{7}H\_{6}O}{106.1 g C\_{7}H\_{6}O}×\frac{6.022×10^{23}mol C}{1 mol C\_{7}H\_{6}O}×\frac{7 atom C}{1 molecule C\_{7}H\_{6}O}=1.99×10^{23}atom C$$

1. (5 points) Determine the empirical formula of benzyl acetate, the scent of jasmine. It is composed of 71.98% C, 6.71% H, and 21.31% O.

$$71.98 g C×\frac{1 mol C}{12.01 g C}=5.99 mol C$$

$$6.71 g H×\frac{1 mol H}{1.008 g H}=6.65 mol H$$

$$21.31 g O×\frac{1 mol O}{16.00 g O}=1.33 mol O$$

$$C\_{\frac{5.99}{1.33}}H\_{\frac{6.65}{1.33}}O\_{\frac{1.33}{1.33}}$$

$$C\_{4.50}H\_{5}O\_{1}\rightarrow C\_{9}H\_{10}O\_{2}$$

1. (3 points) A compound has an empirical formula of C6H7N and a molar mass of 372.5 g/mol. What is the molecular formula of the compound?

Molar mass of C6H7N = 6(12) + 7(1) + 16 = 95 g/mol

 There are 372/95 or 4 units of this in the compound

Molecular formula = C24H28N4

1. (6 points) Balance the following equations
	1. FeS + 2 HCl 🡪 FeCl2 + H2S
	2. 2 C6H14 + 19 O2 🡪 12 CO2 + 14 H2O
2. (6 points) Match each of the following molecules to the correct functional group.
	1.  alcohol (1)
	2.  ester (9)
	3.  alkene (3)
	4.  ether (10)
	5.  carboxylic acid (8)
	6.  ketone (11)

Alcohol

Aldehyde

Alkene

Alkyne

Amide

Amine

Aromatic

Carboxylic acid

Ester

Ether

Ketone