**Exam 2: Chemistry 1984**

**Fall 2013 Alfred State College**

**100 points**

Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 pt A

**2.1. Electronic Trends and Isotopes (12 pts/ 2 pts each)**

1. Rank these neutral elements in order from smallest to largest in atomic radii:

**Cl Al P Br**

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

Smallest largest

1. Ranks these neutral elements in order from smallest to largest first ionization potential:

**F I Li Be**

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

Smallest largest

1. Rank these neutral elements in order from smallest to largest electron affinity:

**Te I S O**

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

Smallest largest

1. Rank these ions in order from smallest to biggest in size

**Mg2+ S2- Al3+ Na+**

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

Smallest largest

1. A new trans-uranium element X has three isotopes with masses 400, 405 and 406 amu.

The % abundance of the 400 and 405 isotopes are 30% and 40%. What is the average atomic mass of X to the nearest 0.1 g/mol?

X’s Average atomic mass= \_\_\_\_\_\_\_

1. What is **not** true about nuclear stability? (circle your answer)
2. Stability is favored by nuclei with neutron count/proton count > 1
3. There is a predicted island of stability past Unobtanium
4. Higher atomic mass is correlated with lower stability.
5. Stability increases as the neutron/proton count becomes < 1.
6. All of the above

\_\_\_/13 includes name

**Chem. 1984 Exam 2a (cont.) p.2/5**

**2.2. Simple Mole-Mass-Count Conversions (assume 1 mole count = 6\*1023 ) 2 pts each/10 pts total**

1. Compute the molecular mass of crystal meth, C10H15N, to the nearest g/mol.

(assume atomic masses: C=12 g/mol, H=1 g/mol , N=14 g/mol)

**MW of C10H15N =** \_\_\_\_\_\_\_\_\_\_\_\_ g/mol

1. How much does 5.711\*10-3 moles of crystal meth weigh to the nearest gram? (show work !)

**6.711\*10-3 mol crystal meth =** \_\_\_\_\_\_\_\_\_\_\_\_ g

1. How many molecules of crystal meth are found in 49.666 g of the crystal meth ?

**49.666 g crystal meth** =\_\_\_\_\_\_\_\_\_\_\_\_meth molecules

1. How many grams of crystal meth are present in 1.209\*1022 molecules of meth ?

**1.209\*1022 molecules meth**= \_\_\_\_\_\_\_\_ g meth

1. How many moles of crystal meth are present in 596 g of the compound?

**596 g meth** =\_\_\_\_\_\_\_\_\_\_\_ mole meth

**2.3. Body Parts (compound element ratio) Mole Calculations (12 pts/ 4 pts each) show work !**

1. You are holding 6.209 g of crystal meth, **C10H15N.** How many grams of **C** are in the sample?

**Grams C in 6.208 g crystal meth = \_\_\_\_\_\_\_\_\_\_\_ g**

1. How many atoms of H are in 0.066666 mol crystal meth ?

**Atoms of H in 0.06666 mol meth = \_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Chem. 1984 Exam 2a (cont.) p. 3/5**

* 1. **Body Parts (compound element ratio) Mole Calculations (continued)**

1. How many grams of C are combined with 0.875 g hydrogen (H) in crystal meth ?

**grams C combined with 0.875 g H in meth=\_\_\_\_\_\_\_\_\_ g**

* 1. **Percent Composition and Combustion Calculations (12 pts/ 4 pts each)**

1. A compound contains by weight: **52.17 g C, 13.04 g H** and **34.78 g O**. What is the compound’s empiric formula? (assume atomic weights: C= 12 g/mol, H =1 g/mol and O=16 g/mol

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ empiric formula**

1. A binary compound contains 0.2308 g C and 0.770 g O. It has a molecular mass of 520 g/mol.

What is molecular formula for the binary?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecular formula**

1. A hydrocarbon (CxHy) is burned in excess O2 to form 0.44 g CO2 and 0.27 g H2O. What is the hydrocarbon’s empiric formula ?

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CxHy empiric formula**

**2.5. Reaction Balancing and Reaction Stoichiometry Problems (17 Pts total)**

1. **Balance us ! ( 7 pts)**

a) \_\_\_\_\_H3PO3 🡪 \_\_\_\_H3PO4 + \_\_\_PH3

b) \_\_\_\_\_C8H18 + \_\_\_\_\_O2 🡪 \_\_\_CO2 + \_\_\_H2O

1. **Given: C3H8 + 5O2🡪 3CO2 + 4H2O**

**MW 44 32 44 18 g/mol 1 mol count = 6\*1023**

**(show work !)**

1. How many grams of O2 are needed to produce 1.2\*1023 molecules of H2O? (5 pts)

**\_\_\_\_\_\_Grams O2 to produce 1.2\*1023 H2O molecules**

1. How many grams of CO2 are produced if we burn 3.00 g C3H8? (5 pts)

**\_\_\_\_\_Grams CO2 produced by burning 3 grams C3H8**

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**Chem. 1984 Exam 2a (cont.) p. 4/5**

* 1. **Limiting Yield and % Yield (15 pts total/5 pts per problem)**

Gasoline (C8H18) burns with O2 stoichiometrically as below:

MW( g/mol) 114 32 44 18

**2C8H18 + 25 O2  🡪 16CO2 + 18 H2O**

1. How many grams of CO2 are formed if we burn 3.2386 g C8H18 and 22.727 g O2 together?

(5 pts)

g CO2 formed = \_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. How many molecules of H2O are formed if 0.231 mol O2 and 0.074 mol C8H18 are burned together ? ( 5 pts)

Molecules H2O formed= \_\_\_\_\_\_\_\_\_\_\_\_\_

1. A 50 gram sample of C8H18 is burned in an excess of O2. A total of 77.19 g of CO2 results.

What is the % yield of the reaction ? (5 pts)

% Yield = ­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. **Nomenclature (8 pts/1 pt per answer)**

Provide the correct name for the formulas below

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    1.  H2S(aq)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    2.  FeCrO4

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    3.  N2O5

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_    4.  MgBr2

Provide the correct formulas for the names below:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_          5.  acetic acid

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_          6.  tetraphosphorous decoxide

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_          7.  cupric oxide

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_          8.  lead (IV) carbonate

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**Chem. 1984 Exam 2a (cont.) p.5 /5**

* 1. **Ionic and Covalent Compounds (13 pts)**
     1. **Ionic Compound building 6 pts (2 pts/answer)**

Predict the likely formulas for binary compounds prepared from:

1. Mg + N = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. K + O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Al + S \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * 1. **Covalent Bonding Using the Lewis Octet Model 6 pts (2 pts/answer)**

Draw the correct Lewis structures for the 3 compounds below, making sure to show all lone pairs.

CO N2 COCl2

Show the formal

charges on C and O

(1 pt)

\_\_\_\_\_/13