**Exam 3: Chem 1013 INTRODUCTORY CHEMISTRY ALFRED STATE 6 May 2013**

\_\_\_/100 pts

Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3.1. Scientific notation and prefixes (10 pts)**

1. Scientific notation < ---- > decimal (1 pt each/5 pts total)
2. Express 4,321 in scientific notation: \_\_\_4.321\*103\_\_\_\_
3. Express 6.02\*101 decimal notation: \_\_\_\_\_60.2\_\_\_\_\_\_\_\_\_\_
4. Express 0.0001234 in scientific notation: \_\_\_1.234\*10-4\_\_\_\_\_
5. Express 5.00\*10-3 in decimal notation: \_\_\_0.005\_\_\_\_\_\_\_\_\_
6. Express 310 in scientific notation: \_\_\_3.1\*102\_\_\_\_\_\_\_\_\_\_
7. Re-write the quantities below in terms of their most reasonable, prefixed equivalents.

*Example: 0.0015 g= 1.5 mg 1 pt each/5 pts total*

1. 2,000 m = \_\_\_\_2 km\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. 0.0000030 s= \_\_3 μs\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. 40,000,000 g = \_\_\_40 Mg\_\_\_\_\_\_\_\_\_\_\_
4. 0.000000005 J=\_\_\_\_5 nJ\_\_\_\_\_\_\_\_\_\_\_\_
5. 60,000,000 bytes= \_\_\_\_60 Mb\_\_\_\_\_\_\_\_

**3.2 Molecular Weight (MW) 5 pts**

Calculate the molecular weights (g/mol) for the compounds below to the nearest gram/mol

(You should use these in problem 3.3 below)

1. H2O \_\_\_\_\_\_\_\_18\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol
2. KOH\_\_\_\_\_\_\_\_\_56\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol
3. NaF \_\_\_\_\_\_\_\_\_42\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol
4. C8H18 \_\_\_\_\_\_\_114\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol
5. Ca3 P2O8 \_\_\_\_\_310\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ g/mol

**3.3. Basic Weight-Mole-molecule count conversions** (**Show work** *or* **no credit** will be given !!)

Note: Avogodro’s number = 6.022 \*1023 = the `chemist’s’ dozen 5 pts each/30 pts total

1. How many grams of H2O are in 0.1111 moles of H2O ? \_\_2\_\_g H2O

0.1111\*18=2

1. How many molecules of KOH are in 37.197 grams of KOH? 4\*1023 molecules KOH

37.197/56 mol \* 6.022\*1023 =4\*1023

1. How many moles of NaF are in 252 grams of NaF? \_\_6\_\_\_ moles NaF

252/42=6

1. How many grams in 4.226 \*1022 molecules of C8H18 ? \_\_8\_\_\_ g C8H18

4.226\*1022/6.022\*1023 mol \* 114 g/mol=8 g

\_\_\_\_/35

**3.3. Basic Weight-Mole-molecule count conversions** (**continued)**

Note: Avogodro’s number = 6.022 \*1023 = the `chemist’s’ dozen

1. How many molecules of C8H18 in 0.16606 mol C8H18 ? \_10\*1022\_ molecules C8H18

0.16606 \*6.022\*1023 molecules=10\*1022

1. How many moles of Ca3P2O8 in 7.2264\*1024 molecules of Ca3 P2O8? \_12\_\_\_moles Ca3 P2O8 7.2264\*1024/6.022\*1023 =12
   1. **% Composition Problems (12 pts/ 4 pts each)**
2. A sample of compound composed of C,H and O contains 0.720 g C, 0.120 g H and 0.640 g O, determine the empiric formula of the compound:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element | Weight, g | AW g/mol | n=weight/AW | n/nmin | 2\*n/nmin |
| C | 0.72 | 12 | 0.72/12=0.06 | 0.06/0.04=1.5 | 3 |
| H | 0.12 | 1 | 0.12/1=0.12 | 0.12/0.04=3 | 6 |
| O | 0.64 | 16 | 0.64/16=0.04 | 0.04/0.04=1 | 2 |

\_\_C3H6O2\_\_\_\_\_\_\_\_ empiric formula

1. A mystery liquid has a molecular weight of 320 g/mol . A sample of it contains 30.0% C, 2.50% % H, 17.5 % N and 50.00 % O. What is the molecular formula of the liquid ?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Element | Weight, g | AW g/mol | n=weight/AW | n/nmin | 2\*n/nmin |
| C | 30.0 | 12 | 30/12=2.5 | 2.5/1.25=2 | 4 |
| H | 2.5 | 1 | 2.5/1=2.5 | 2.5/1.25=2 | 4 |
| N | 17.5 | 14 | 17.5/14=1.25 | 1.25/1.25=1 | 2 |
| O | 50.0 | 16 | 50/16=3.125 | 3.125/1.25=2.5 | 5 |

MW empiric=160

\_\_\_C8H8N4O10\_\_\_\_ molecular formula (MW= 320 g/mol)

1. 40 grams of iron powder (=Fe. Atomic mass=55.85 g/mol) is heated in air for several days. A black oxide powder containing both Fe and O results. The black powder weighs 51.459 g. What is the

formula for the black FeOx compound . (The atomic mass of O=16 g/mol)

**grams O= 51.459 – 40 =11.459**

**mol O= 11.459/16=0.716**

**mol Fe= 40/55.85=0.716**

* FeO

\_\_\_/22

**3.5 Balancing (9 pts) [Show work for each problem or no credit]**

**Balance these reactions: (3 pts each/9 pts total)**

**\_2\_AgNO3 + \_1\_H2SO4 \_\_1\_\_\_Ag2SO4 + \_\_2\_HNO3**

**\_\_1\_CH4 + \_\_4\_\_H2S \_\_1\_\_\_CS2 + \_1\_\_S2H6­­ + \_\_\_3\_ H2**

**\_\_2\_\_C4H10 + \_9\_\_O2  \_8\_\_\_\_CO + \_\_10\_\_H2O**

**3.6. Stoichiometry Problems (15 points/ 5 pts per problem) Must show work for credit**

**(Assume 1 mole count = 6.022\*1023)**

**C3H8 + 5O2 --------🡪 3CO2 + 4H2O**

**MW(g/mol) 44 32 44 18 g/mol**

1. **Compute the number of grams of H2O created by burning 0.13889 moles O2 ? \_\_2\_\_\_\_\_\_g H2O**

**0.1388\*4/5 = mol H2O =0.11104 mol H2O =>0.11104\*18 g/mol=2**

1. **Compute the number of molecules of H2O created by burning 3.654 g C3H8\_\_\_\_2\*1023 MOLECULES**

**3.654/44= mol C3H8=0.08304**

**Mol H2O/mol C3H8= 4/1=x/0.08304=> x= mol H2O =4\*0.08304=0.33218**

**Molecules = 6.022\*1023 \*0.33218=2\*1023**

1. **Compute the number of moles of CO2 created by consuming 29.333 g C3H8? \_\_2\_\_\_\_mol C3H8**

**29.333/44= mol C3H8 =0.6666**

**Mol CO2/mol C3H8 =3/1 =x/0.6666=>mol CO2 = x=3\*0.6666=2**

**3.7. Limiting Reagent Problems (10 points/5 points per problem)**

**Given: 2Al + 6HCl 🡪 2AlCl3 + 3H2**

**MW(g/mol) 27 36 133 2 g/mol**

1. **How many moles of H2 can form if 1.333 moles of Al and 8 moles of HCl are combined ?**

**Excess HCl=> Al limits**

**Mol H2/mol Al= 3/2 = n/1.333=> n=1.333\*3/2=2**

**\_\_2\_\_mol H2**

1. **How many grams of AlCl3 can form if 0.406 grams of Al and 9.0 grams of HCl are combined?**

**0.406 g Al/27=0.01504 mol Al**

**9 g HCl/36=0.25 mol HCl excess=> Al limits again**

**AlCl3 mol/Al mol =2/2=1=> 0.01504 mol AlCl3\*133=2**

**\_\_/34 \_\_\_2\_\_ grams AlCl3**

**3.8. Chemical True/False (9 pts/ 1 pt per answer)**

1. **The mole concept and dozen concept are essentially the same. T F**
2. **Stoichiometry and Souffle recipe calculations are essentially the same. T F**
3. **There’s nothing special about Avogodro’s number. T F**
4. **Avogodro measured Avogodro’s number. T F**
5. **Molecular weights are in units of grams/mol. T F**
6. **The empiric formula is the same as molecular formula. T F**
7. **The atomic masses listed on the Periodic Table are relative masses in amu. T F**
8. **To find mass from moles, multiply down T F**
9. **Any day doing chemistry is a good day. T T**

**\_\_\_/9**