**Exam 2: Chem 1114 Spring 2018**

**Version A 100 points**

**Your name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 1 pt**

1) **The molecular mass of crystal meth (C10H13N) is 149 g/mol.**

a) How many grams of crystal meth are formed from 0.9395 g N? The atomic mass of N=14 g/mol SHOW WORK

0.9395/14= mol N=0.0671 mol meth/mol N=1/1 => mass meth=0.0671\*149=10

 \_10\_\_\_ g meth 7 pts

2a) A suspicious, probably illegal white powder contains 8.054 g C, 1.007 g H and 0.9396 g N.

What is the powder’s empiric formula ?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Mass (g)** | **Atomic mass (g/mol)** | **mol** | **n/nmin** |
| **C** | **8.054** | **12** | **0.6711** | **10** |
| **H** | **1.007** | **1** | **1.007** | **15** |
| **N** | **0.9396** | **14** | **0.067** | **1** |

 Empiric formula = C H N 7 pts

 10 15 1

2b) A sugar with the molecular weight 180 g/mol has the following masses of C, H and O in a 10 gram

 sample. What is the molecular formula for the sugar ?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Mass (g)** | **Atomic mass (g/mol)** | **Mol** | **n/nmin** | **X6** |
| **C** | **2.000** | **12** | **0.1666** | **1** | **6** |
| **H** | **0.3335** | **1** | **0.333** | **2** | **12** |
| **O** | **2.6665** | **16** | **0.1666** | **1** | **6** |

Molecular formula = C H O CH2O MW=30 7 pts

 6 12 6 180/30=6

3a) A 16.3475 gram sample of Zn metal is burned in oxygen to produce a 20.3475 gram sample of a zinc oxide compound. Given that the atomic masses of Zn and O are 65.39 and 16 g/mol respectively, what is the empiric formula of the zinc oxide compound? 7 pts

 20.3475-16.3475=g O=4 g => 4/16=0.25 mol O

16.3475/65.39= mol Zn=0.25

 \_\_ZnO\_\_\_\_\_zinc oxide formula

\_\_/29 includes name

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3a)A hydrocarbon with the formula CxHy is burned to form 22 grams CO2 and 9.0 grams of H2O.

 Given the molecular weights : CO2 = 44 g/mol, H2O=18 g/mol, provide a whole-numbered

 formula for CxHy. SHOW WORK

mol C=22/44=0.5 mol H=2\*9/18= 1=> CH2

CxHy= CH2 7 pts

4. Balance the reactions below: (1 pt each/11 pts total)

a) \_\_\_2\_ Cu + \_\_1\_\_O2 🡪 \_\_2\_\_CuO

b) \_1\_MgSO4 + \_2\_LiF -🡪 \_1\_MgF2 +\_\_1\_ Li2SO4

c) \_2\_C8H18 +\_\_25\_\_O2🡪 \_\_16\_\_CO2 + \_18\_\_H2O

5)Butane (C4H10) has a molecular weight of 58 g/mol and burns according to the stoichiometrically balanced reaction below:

2C4H10 +13 O2 🡪 8CO2 + 10H2O

How many moles of butane are consumed if we have formed 880 g of CO2 (MW=44 g/mol) ? SHOW WORK

880/44=20 mol CO2 mol butane/mol CO2 = 2/8=x/20 => x= 20\*2/8=5

 \_\_\_\_5\_\_ mol butane 7 pts

6) Propane (C3H8) burns according to the stoichiometrically balanced reaction below:

C3H8 +5 O2 🡪 3CO2 + 4H2O

 MW (g/mol) 44 32 44 18

 a) How many grams of H2O form when we burn 26.6666 grams of O2 ? (SHOW WORK !)

26.6666/32=0.83333 mol O2 mol H2O/mol O2 =x/0.8333 = 4/5=> x=0.6666 mol H2O \*18=12 g

\_\_\_12\_\_\_\_ g H2O 7 pts

7) Octane burns according to the balanced equation:

 2C8H18 + 25O2 🡪 16CO2 +18H2O

MW 114 32 44 18

a) If we combine 11.4 g C8H18 and 22.727 g O2 how many grams of CO2 can you form ? SHOW WORK

11.4/114=0.1 mol C8H18 => 16/2=x/0.1=> mol CO2 =0.8

22.727/32=0.710 mol O2=> 16/25=y/0.710=> mol CO2=0.4544 limits=> 0.4544\*44=20 g

 \_\_20\_\_ g CO2 7 pts \_\_\_\_/39

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8. Pentane, C5H12, burns according to the balanced equation:

 C5H12 + 8 O2  🡪 5CO2  + 6H2O

A 54 g sample of pentane (MW= 72 g/mol) is experimentally burned in excess O2 to experimentally produce 2.25 moles of H20. What is the % yield of the reaction?

Max mol H2O = 6\*54/72 =4.5=> 2.25/4.5=0.5=> 50%

 \_50\_=% yield 7 pts

9. In the Arrhenius acid-base theory:

a) An acid is a(n)\_\_\_\_\_\_\_H+ donor\_\_\_\_\_\_\_\_\_\_\_\_\_

b) A base is a(n)\_\_\_\_\_\_\_\_\_\_OH- donor\_\_\_\_\_\_\_\_\_\_\_

c) acids + bases 🡪 \_\_\_\_\_\_\_\_\_\_\_\_salt + water\_\_\_\_\_\_\_\_

10. In the Bronsted acid-base theory

a) An acid is a(n)\_\_\_\_\_proton donor\_\_\_\_\_\_\_\_\_\_

b) A base is a(n)\_\_\_\_\_\_proton acceptor\_\_\_\_\_\_\_\_\_\_\_

c) acids + bases 🡪 \_\_\_\_\_\_\_\_\_\_\_conjugate acids and bases\_\_\_\_\_\_\_\_\_\_\_\_

d) the conjugate acid of NH3 is: \_\_\_\_\_\_\_NH4+\_\_\_\_\_\_\_\_\_\_\_\_

e) Write out the hydrolysis reaction for CO32- in water:

CO32- + H2O 🡪 OH‑ + HCO3-

11. Identify the acid (A) , base (B) conjugate acid (CA) and conjugate base (CB) in the reaction below:

HPO32- + HCO3- 🡪 H2 PO3- + CO32- 2 pts

\_B\_\_ \_\_A\_\_ \_CA\_\_ \_\_CB\_\_\_

12. What is the net ionic equation for: Ag+ + NO3- + Na+ +Cl- 🡪 AgCl(s) + Na+ + NO3-

**Ag+ + Cl- 🡪 AgCl**

13. What are the oxidation numbers of all the elements in the compounds below: (1 pt each/ 7 pts total)

 a) SO2 S oxidation #=\_\_4\_\_ O oxidation # = \_\_-2\_\_\_\_

 b) CuCl2 Cu oxidation #=\_2\_\_ Cl oxidation #=\_\_-1\_\_\_\_

 c) H2SO4 H oxidation #=\_1\_\_ O oxidation # =\_-2\_\_ S oxidation #=\_\_6\_\_

14. Oxidation = \_\_\_\_losing\_\_\_\_\_\_\_electrons

15. Reduction= \_\_\_\_gaining\_\_\_\_\_\_\_ electrons

16. What are elements oxidized and reduced in the reactions below:

 CH4 + 2O2 🡪 CO2 + 2H2O

 \_\_C\_\_\_oxidized \_\_\_O\_\_\_ reduced

 Co2O + Zno 🡪 ZnO + 2Coo

 \_\_Zn\_\_ oxidized \_\_Co\_\_ reduced

17. Any day doing Chemistry is a \_\_\_\_great\_\_\_\_\_\_\_\_\_\_\_ day

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