**Exam 2: Chem 1114 Spring 2018**

**Version B 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 16.107 g C? The atomic mass of C=12 g/mol SHOW WORK

**16.107/12=1.34225 mol C=> mol meth = 1/10 \* 1.34225=0.134225\* 149 g/mol=20 g**

\_\_20\_\_ g meth 7 pts

2a) A sweet-tasting white powder contains 20.00 g C, 3.333 g H and 26.665 g O.

What is the powder’s empiric formula ?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Mass (g)** | **Atomic mass (g/mol)** | **Mol** | **n/nmin** |
| **C** | **20** | **12** | **1.666** | **1** |
| **H** | **3.333** | **1** | **3.333** | **2** |
| **0** | **26.665** | **16** | **1.666** | **1** |

Empiric formula = C H O 7 pts

1 2 1

2b) A sugar with the molecular weight 720 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** |  |
| **C** | **8.000** | **12** | **0.666** | **1** | **24** |
| **H** | **1.334** | **1** | **1.334** | **2** | **48** |
| **O** | **10.666** | **16** | **0.666** | **1** | **24** |

Molecular formula = C H O 720/30=24 CH2O MW=30 7 pts

24 48 24

3a) A 14.6732 gram sample of Ni is burned in oxygen to produce a 22.6732 gram sample of a nickel oxide compound. Given that the atomic masses of Ni and O are 58.693 and 16 g/mol respectively, what is the empiric formula of the nickel oxide compound? 7 pts

g O= 22.6732-14.6732=8 g O=>0.5 mol O

mol Ni=14.6732/58.693=0.25 mol Ni => NiO2

\_\_NiO2\_\_\_nickel oxide formula

\_\_/25 includes name

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3a)A hydrocarbon with the formula CxHy is burned to form 5.5 grams CO2 and 4.5 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=mol CO2 =5.5/44=0.125

mol H= 2\* mol H2O= 2\*4.5/18=0.5 =>CH4

CxHy= CH4 7 pts

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

a) \_1\_MgSO3 + \_2\_KCl -🡪 \_1\_MgCl2 +\_1\_\_ K2SO3

b) \_2\_C6H14 +\_\_19\_\_O2🡪 \_\_\_12\_CO2 + \_14\_\_H2O

c) \_\_2\_\_Mg + \_1\_\_\_O2 🡪 \_2\_\_\_MgO

5)Octane (C8H18) has a molecular weight of 114 g/mol and burns according to the stoichiometrically balanced reaction below:

2C8H18 +25 O2 🡪 16CO2 + 18H2O

How many moles of O2 are consumed if we have formed 281.6 g of CO2 (MW=44 g/mol) ?

SHOW WORK

281.6/44=6.4 mol CO2 mol O2/mol CO2 = 25/16=x/6.4 => x= 25\*6.4/16=10

\_\_10\_\_\_\_ mol O2 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 CO2 form when we burn 24.2424 grams of O2 ? (SHOW WORK !)

mol O2 = 24.2424/32=0.7575 mol CO2/mol O2 =3/5=x/0.7575=> x=0.4545=> 0.4545\*44=20

\_\_20\_\_\_ g CO2 7 pts

7) Butane burns according to the balanced equation:

2C4H10 + 13O2 🡪 8CO2 +10H2O

MW 58 32 44 18

a) If we combine 11.6 g C4H10 and 11.8182 g O2 how many grams of CO2 can you form ? SHOW WORK

11.6/58= mol C4H10 =0.2=> mol CO2/mol C4H10= 8/2=x/0.2=>x=0.8

11.8182/32=mol O2 =0.3693=> mol CO2/mol O2 = 8/13=x/0.3693=> x=0.227 limits

0.227\*44=10

\_10\_\_\_ 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 produce 1.125 mol H2O. What is the % yield for the reaction ? SHOW WORK

Max mol H2O = 6\*54/72 =4.5=> 1.125/4.5=0.25=> 25%

\_\_25\_\_=% yield 7 pts

9. 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 base\_\_\_\_\_\_\_\_\_\_\_

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

e) Name of the reaction Bronsted introduces to explain how a base `splits’ water:

\_\_\_hydrolysis\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ reaction

10. 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 🡪 \_\_\_\_\_\_\_\_\_\_\_\_salts and water\_\_\_\_\_\_\_\_\_\_

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

HCO3- + HPO3- 🡪 H2CO3 + PO32- 2 pts

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

12. What is the net ionic equation for: Ca2+ + 2NO3- + 2Na+ +SO42- 🡪 CaSO4(s) + 2 Na+ +2 NO3-

Ca2+ + SO42- 🡪 CaSO4(s)

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

a) CO C oxidation #=\_+2\_\_\_ O oxidation # = \_\_\_-2\_\_\_

b) CuCl Cu oxidation #=\_\_+1\_ 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

CoO + Zn 🡪 ZnO + Coo

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

17. What is Doc’s favorite animal ? \_\_\_\_\_cat\_\_\_\_\_\_\_\_\_\_ (hint: they meow and chase mice)

\_\_/30