**Exam 2: Chem 1114 Fall 2014**

**Version A 100 points**

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

1) The compound glucose has the formula: C6H12O6 and a molecular mass of 180 g/mol.

a) How many moles of O are found in 30 g of glucose ? (show work or no credit)

\_\_\_\_\_\_ mol O 4 pts

b) How many grams of C are in 5.00 grams of glucose ?

\_\_\_\_\_\_ g C 4 pts

c) A sample of glucose contains 240 grams of H. How many moles of glucose are in the sample?

\_\_\_\_\_ mol glucose 4 pts

2a) A suspicious, probably illegal white powder contains 80.54% C, 10.07% H and 9.396 % N.

What is the powder’s empiric formula ?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Element** | **Mass (g)** | **Atomic mass (g/mol)** |  |  |
| **C** |  | **12** |  |  |
| **H** |  | **1** |  |  |
| **N** |  | **14** |  |  |

Empiric formula = C H N 4 pts

2b) A sugar with the molecular weight 360 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)** |  |  |  |
| **C** | **4.000** | **12** |  |  |  |
| **H** | **0.667** | **1** |  |  |  |
| **O** | **5.333** | **16** |  |  |  |

Molecular formula = C H O 4 pts

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3a)A hydrocarbon with the formula CxHy is burned to form 22 grams CO2 and 9 grams of H2O.

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

formula for CxHy.

CxHy= 5 pts

3b) A nitrogen oxide (Nx Oy) compound decomposes to form 1.4 g N2 and 0.8 g O2. Given that the

atomic masses of N= 14 g/mol and O = 16 g/mol, what is the empiric formula for Nx Oy ?

Nx Oy = 5 pts

4. Balance the reactions below: (1 pt each/12 pts total)

a) \_\_\_\_H2 + \_\_\_\_O2 🡪 \_\_\_\_H2O

b) \_\_Fe2(SO4)3 + \_\_NH3 + \_\_H2O 🡪 \_\_Fe(OH)3 + \_\_ (NH4)2SO4

c) \_\_C7H16 +\_\_\_\_O2🡪 \_\_\_\_CO2 + \_\_\_H2O

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 water form if we burn 222.22 g O2 (MW=32 g/mol) ?

\_\_\_\_\_\_\_\_ mol water 5 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 12.22 grams of C3H8 ? (Show work !)

\_\_\_\_\_\_\_ g H2O 5 pts

b)How many grams of H2O form from 2.5\*1023 molecules of O2. (1 mol count = 6\*1023 molecules)

\_\_\_\_\_\_\_ g H2O 5 pts

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7) Butane burns according to the balanced equation:

2C4H10 + 13O2 🡪 8CO2 +10H2O

MW 58 32 44 18

a) If we combine 0.6591 g C4H10 and 5.200 g O2 how many grams of CO2 can you form ?

\_\_\_\_\_\_ g CO2 5 pts

b) How many molecules of H2O form by burning 2\*1022 molecules of C4H10 and 0.6933 g O2 ?

(1 mol count=6\*1023 molecules)

\_\_\_\_\_\_\_ molecules H2O 5 pts

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

C5H12 + 8 O2  🡪 5CO2  + 6H2O

MW 72 g/mol

An 54 g sample of pentane is experimentally burned in excess O2 to produce 1.125 mol H2O.

What is the % yield for the reaction ?

\_\_\_\_=% yield 5 pts

9. In the Arrhenius acid-base theory:

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

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

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

10. In the Bronsted acid-base theory

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

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

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

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

11. What are the conjugate acid (CA) and conjugate base (CB) in the reaction below:

HPO32- + CO32- 🡪 PO33- + HCO3-

CA=\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CB= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

12. A 25 mL volume of an unknown HCl sample is titrated to a pale pink phenolphthalein endpoint with

12.5 mL of 0.100 mol/L NaOH. What is the unknown HCl’s concentration ?

\_\_\_/28 \_\_\_\_\_\_ HCl concentration (mol/L) 5 pts

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

a) NO2 N oxidation #=\_\_\_\_ O oxidation # = \_\_\_\_\_\_

b) CuCl Cu oxidation #=\_\_\_ Cl oxidation #=\_\_\_\_\_\_

c) H2SO4 H oxidation #=\_\_\_ O oxidation # =\_\_\_\_ S oxidation #=\_\_\_\_

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

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

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

CH4 + 2O2 🡪 CO2 + 2H2O

\_\_\_\_\_oxidized \_\_\_\_\_\_ reduced

Ag2O + Zn 🡪 ZnO + 2Ag

\_\_\_\_ oxidized \_\_\_\_\_ reduced

17. What feature below is not typical of acid-base reactions:

a) light created b) heat generated c) indicator colors change d) protons exchanged

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