**Exam 3B General Chemistry 1114 Alfred State College Mon 25 November 2013 B p. 1/4**

Your name: \_\_\_\_\_ANSWERS\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (1 pt)

**3.1 Reaction Stoichiometry, Limiting Reagent and % Yields (5 pts each/20 points total)**

a) How many grams of CO2 are formed in the reaction below when 0.32575 g of C6H14 are

burned with excess O2 in the balanced reaction below ? (Must show work for credit)

**Molecular mass 86 32 44 18 g/mol**

**2C6H14 + 19 O2 🡪 12CO2+ 14H2O**

**Mol C6H14= 0.32575/86=3.7877E-3 mol CO2/mol C6H14  = 12/2= m/3.7877E-3 => m= 12\*3.7877E-3/2=0.02273 mol CO2**

**=>mass CO2 =44\*0.02273=1 g**

**\_\_1\_\_\_ g CO2**

b) Using the same balanced reaction above, predict the grams of H2O expected if 4.8253 g of O2 and

3.4127 g C6H14 are burned together. (Must show work for credit)

**O2: 4.8253/32 = mol O2=0.1507 => mol H2O/mol O2= 14/19= m/0.1507=> m=0.1507\*14/19=0.1111 Limits**

**C6H14: 3.4127/86=mol C6H14=0.03968=> mol H2O/mol C6H14=14/2=m/0.03968=> m=0.03968\*14/2=0.2777**

**Mass of H2O= 0.1111\*18=2 g**

**\_\_\_2\_\_\_ g H2O**

c) Using the same balanced reaction above, compute the molecules of CO2 created if 8.333\*10‑3 mol

of C6H14 and 0.3958 mol O2 are reacted (Must show work for credit) 1 mol count=6\*1023

**C6H14 m/8.333E-3 = 12/2 => m=12/2\*8.333E-3=0.05 limits**

**O2 m/0.3958= 12/19=>m=12\*0.3958/19=0.25**

**0.05\*6\*1023 =3\*1022**

**\_3\*1022\_\_\_ molecules CO2**

d) Using the same balanced reaction above, determine the % yield of H2O if 6.25 grams of CO2 result from burning 4.072 g C6H14 in an excess of O2.

**4.072 g C6H14/86 = mol C6H14=0.0473 mol C6H14**

**=> theoretical yield of CO2=12\*0.0473/2 =0.284 mol CO2 => 0.284\*44 g =12.5 grams theory**

**% yield = 100\*6.25/12.5=50%**

This problem will be credited to you since it is mis-stated here. My mistake.

**\_\_\_\_50\_\_\_\_\_\_\_% yield CO2**

**\_\_\_/21 (includes your name)**

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**3.2 Ions and Ionic Compounds (14 pts)**

**3.2.1. Trends and Behaviors (4 pts)**

a)As you go down a column of the Periodic Table, the ionic radii of the elements \_\_increase\_\_\_

b) Metals mostly prefer: **positive negative no** charge

c) alkali prefer to be: **positive negative neutral**

d) A high electronegativity for a neutral element means it most likely will form:

**a cation an anion a radical a bagel**

**3.2.2. Predict The Ionic Compound (10 pts)**

Using the Periodic Table provided, predict the most likely compounds formed from the pairs of elements below:

**a) Mg + As \_Mg3As2\_\_\_\_ b) B + O \_\_\_\_B2O3\_\_\_\_ c) Na + Se \_\_Na2Se\_**

**d) Be + F \_\_BeF2\_\_\_\_\_ e) B + F \_\_\_BF3\_\_\_\_\_\_\_\_\_**

**3.3. Lewis Structures and Formal Charges 18 pts total)**

**3.3.1. Octet only predictions (2 pts each/ 6 pts total)**

a) Draw the best Lewis structures **assuming the octet rule must be obeyed** for each species below.

Make sure to indicate lone pairs and any formal charge that is present on individual atoms.







**NO2-1 SO3 COCl2**

**3.3.2. Extended Lewis Model predictions (3 pts each/6 pts total)**

Draw the best Lewis structures for the compounds below which satisfy the extended Lewis model Make sure to show all lone pairs and formal charge. (Remember that the best extended Lewis structure requires breaking the octet rule to minimize formal charge.)





**SO32- SF6**

**3.3.3. Resonance Predictions (3 pts)**

Circle all the molecular structures you drew above that exhibit resonance

**NO2- SO3 COCl2  SO32-  SF6**

**3.3.4 VSEPR structures (e.g. bent, trigonal planar etc….) (3 pts)**

What are the shapes of: **SO3\_\_trigonal planarz\_\_\_\_ SF6\_octahedron\_\_\_\_ SO32-\_\_\_ trigonal pyramid**

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**3.4. Metatheses Reactions (10 Pts)**

a) Write the complete balanced molecular, complete ionic and net ionic equation for the

reaction of mercuric nitrate (Hg(NO3)2 with calcium chloride (MgCl2) given that both are

soluble in water and form an insoluble mercuric chloride precipitate. (6 pts/2 pts per line)

**Complete Molecular Hg(NO3)2(aq) + CaCl2(aq)🡪 HgCl2(s) + CaCl2(aq)**

**Complete Ionic Hg2+ +2NO3- + Ca2+ +2Cl- 🡪 HgCl2(s) + Ca2+ +2Cl-**

**Net Ionic Hg2+ + 2Cl- 🡪 HgCl2(s)**

b) List three characteristics common to metatheses reactions

**1.\_\_\_\_\_\_\_\_\_\_\_\_low heat\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.\_\_\_\_\_\_\_\_\_\_\_\_ppt forms\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3.\_\_\_\_\_\_\_\_\_\_\_\_involves aqueous soluble reactants\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

d) What’s another name for metathesis reactions? \_\_\_double replacement\_\_\_\_\_\_\_\_

**3.4 Acid-Base Reactions (14 pts)**

a)An Arrhenius acid= \_\_H+ donor\_\_\_\_\_\_\_\_\_\_ A Bronsted acid = \_\_proton donor\_\_\_\_\_\_\_

b)An Arrhenius base=\_OH- donor\_\_\_\_\_\_\_\_\_ A Bronsted base= \_\_proton acceptor\_\_\_\_\_

c)In the Arrhenius theory:

Acid+Base 🡪 **\_salt\_\_\_\_\_\_\_\_\_\_\_ + \_\_\_\_water\_\_\_\_\_\_\_** 1 pt

d)In the Bronsted theory:

Acid + Base 🡪 \_**conjugate base\_\_\_\_\_\_\_\_\_\_ + conjugate acid\_\_\_\_\_\_\_\_** 1 pt

e)Which are not Arrhenius bases, but can be Bronsted bases in the list below: (2 pts)

**CO32- HBr Cl- OH‑  NH4+**

f) Identify the bases (B), acids(A), conjugate acids (CA) and conjugate bases (CB) below:

i**) CO32- + HPO32- 🡪 HCO3- + PO33-** 2 pts

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

ii) **H3PO4 + Na3PO4 🡪 NaH2PO4 + HNa2PO4**  2 pts

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

g) **CO32- + H2O🡪 HCO3- + OH-** is called a(n) \_\_hydrolysis\_\_\_\_\_\_\_\_\_\_reaction

h) Phenophthalein is a(n) \_\_\_**indicator\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**

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**3.5. Titration problem (4 pts)** (show work or no credit)

50.00 mL of an unknown acid is titrated to equivalence when 40 mL of a 0.25 mol/L base is added. What is the concentration of the unknown acid ?

**50.00\*Ca =40\*0.25=> Ca =40\*0.25/50=0.20**

**\_0.20\_\_=CA (mol/L)**

**3.5. Gas Problem (4 pts)** (show work or no credit)

You run the reaction: 2Al(s) + 6HCl(aq) 🡪 3H2(g) + 2AlCl3(aq) using 0.270 g of Al (at. wt. = 27.0 g/mol). This produces, according to the Ideal Gas equation, 1.515\*10-2 mol H2.

a)How many moles of H2 should you get from the reaction if it runs to completion ?

0.27/27=0.01 mol Al+> 3/2 \*0.01 mol H2 =0.0150 mol H2

mole H2 based on Al \_\_\_0.015\_\_\_\_

b) What is your % EDA to the nearest 0.1% ? % EDA=\_\_\_\_\_\_\_1\_\_\_\_\_\_\_ to nearest 0.1%

(0.01515-0.015) \*100 =1 .0

0.015

* 1. **Redox Basics (10 pts)**

1. What gets exchanged in a redox reaction ? \_\_electrons\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Oxidation means \_\_\_\_\_lose electrons\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Reduction means\_\_\_\_\_gain electrons\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. Determine the oxidation numbers for all the elements in the compounds below:

NaCl Na\_\_+1\_\_\_\_ Cl\_\_\_\_-1\_\_\_

K2SO4 K \_\_\_+1\_\_ S\_\_\_6\_\_\_\_\_ O\_\_-2\_\_\_\_

O2 + C 🡪 CO2 oxidized=\_\_\_\_C\_\_\_\_\_ reduced = \_\_\_\_O\_\_\_

**3.7. Multiple Choice and T/F (5 pts)**

Which chemist worked at Berkeley: **Lewis Bronsted Arrhenius**

Which chemist predicted global warming? **Lewis Bronsted Arrhenius**

Which chemist invented `hydrolysis’ ? **Lewis Bronsted Arrhenius**

The octet rule must always be obeyed. **True False**

Any day doing chemistry is a good day **True True**

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