**Exam 3 General Chemistry 1114 Alfred State College Wed 5 December 2012**

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

**3.1 Reaction Stoichiometry, Limiting Reagent and % Yields (5 pts each/15 points total)**

a) How many grams of water are formed in the reaction below when 1.4074 g of C8H18 are

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

**Molecular mass 114 32 44 18 g/mol**

**2C8H18 + 25 O2 🡪 16CO2+ 18H2O**

**1.407/114=0.0123 mol C8H18**

**Mol H2O/mol C8H18= 18/2= m/0.0123**

**m=18\*0.0123/2=0.111**

**grams H2O= 0.111 mol\*18 g/mol =2 g**

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

b) Using the same balanced reaction above, predict the grams of CO2 expected if 3.409 g of O2

and 3.8863 g C8H18 are burned together. (Must show work for credit)

**mol C8H18= 3.883/114=0.03406 => mol CO2/Mol C8H18 = 16/2=m/0.03406=> m=0.272**

**mol O2 =3.409/32=0.106=> mol CO2/mol O2 = 16/25= m/0.106=> m=0.068179 smaller**

**=>O2 limits**

**Grams CO2 =0.06817 mol\*44 g/mol= 3 g**

**\_\_\_3\_\_\_ g CO2**

c) Using the same balanced reaction above, compute the % yield for the reaction if 1.14 g of C8H18 in excess O2 yields 0.810 g H2O. (Must show work for credit)

**mol C8H18= 1.14/114=0.01 .**

**In theory: theory mol H2O/mol C8H18 = 18/2= mtheory (H2O) /0.01**

**=> mtheory (H2O)= 18\*0.01/2=0.09**

**Experimentally, mol H2O = 0.81 g\*1 mol H2O/18 g=0.045 moles**

**% yield = 100\* Experimental moles/theory moles =100\*0.045/0.90=50%**

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

**\_\_\_/15**

**3.2 Lewis Structures and Formal Charges (4 pts each/28 pts total)**

Draw the best Lewis structures for the compounds below. Make sure to show all lone pairs, formal charge and write an `R’ next to your structure if resonance exists. (Remember that the best Lewis structure sometimes requires breaking the octet rule to minimize formal charge.)



**(-):C≡O: (+)**

**CO SOCl2🡪 Cl-O-S-Cl**





**R**

**O O**

**| |**

**SO3 🡪 O-S-O NO3- 🡪 O-N-O**

Draw the best Lewis structure for the compounds below. Make sure to show all lone pairs and indicate any formal charges. (Remember that the best Lewis structure sometimes requires breaking the octet rule to minimize formal charge.)





**All Cl have 3**

**Sets of lone**

**Pairs**

**PCl5 SO2**



**\_\_\_/28 COCl2**

**3.3. Metatheses Reactions (11 Pts)**

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

reaction of silver nitrate (AgNO3) with calcium chloride (CaCl2) given that both are

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

**Complete Molecular**

**2AgNO3(aq) + CaCl2(aq) 🡪 2AgCl(s) + Ca(NO3)2(aq)**

**Complete Ionic**

**2Ag+ + 2NO3- + Ca2+ +2Cl- 🡪 2AgCl(s) +Ca2++2NO3-**

**Net Ionic**

**Ag+ +Cl- 🡪 AgCl(s)**

b) List three characteristics common to metatheses reactions

**1.\_\_\_\_\_\_\_metals exchange\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2.\_\_\_\_\_\_\_precipitates form\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**3.\_\_\_\_\_\_\_\_low energy output\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

c) In the complete ionic equation: Hg2+ + 2NO3- + 2Na+ + S2- 🡪 HgS(s) + 2NO3- +2Na+

what specie(s) are spectator ions ? **\_\_\_\_\_\_\_\_\_NO3-, Na+\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

d) What’s another name for metatheses 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 base (B), acid(A), conjugate acid (CA) and conjugate base (CB) below:

**B A CA CB**

i) NH3 + HBr 🡪 NH4+ + Br- 2 pts

**A B CB CA**

ii) H3PO4 + Na3PO4 🡪 NaH2PO4 + HNa2PO4 2 pts

g)List two characteristics common to Acid-Base Reactions

1)\_\_\_\_\_\_\_\_\_\_**indicators used,\_\_heat generated\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**2)\_\_\_\_\_\_\_\_\_\_special definitions for acid/base, salt + water and neutralization products\_\_\_\_**

\_\_\_/25

**3.5. Redox Reactions (24 pts)**

1. What exchange/change is common and defining for redox reactions ?

\_\_\_\_\_\_\_\_\_\_\_\_\_electrons (e-) exchanged between different elements\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Oxidation means \_\_\_\_\_\_\_\_losing e-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Reduction means\_\_\_\_\_\_\_gaining e-\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. At which electrode does oxidation occur ? \_\_anode\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. At which electrodes does reduction occur ?\_\_\_\_cathode\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. Determine the oxidation numbers for all the elements in the compounds below:

MgCl2 Mg\_\_\_+2\_\_\_ Cl\_\_\_-1\_\_\_\_

PbSO4 Pb \_+2\_\_\_\_ S\_\_\_\_+6\_\_\_\_ O\_\_\_-2\_\_\_

KBr K\_\_+1\_\_\_\_ Br\_\_\_-1\_\_\_\_

KMnO4 K \_\_+1\_\_\_ Mn \_\_\_+7\_\_\_\_ O \_\_\_\_-2\_\_\_\_

1. Decide whether the reactions below are redox reactions

1. 4Fe + 6O2 🡪 2Fe2O3 **redox** not redox
2. H2CO3 🡪 H2O + CO2 redox **not redox**
3. Mgo + Cu2+🡪 Mg2++Cuo **redox** not redox
4. Fe2+ + O2- 🡪 FeO redox **not redox**
5. What are the reduction and oxidation half-cells for the redox reaction:

2Feo + 3Cu2+ 🡪 2Fe3+ + 3Cu0

Reduction half-cell: **3Cu2+ +6e- 🡪3Cuo**

Oxidation half-cell: **2Feo 🡪2Fe3++6e-**

1. Determine who gets oxidized and who gets reduced in the reactions below: (3 pts)

2HCl + Mg🡪 Mg2+ + H2 + 2Cl- oxidized = \_\_\_**Mg**\_ reduced = **H\_\_\_\_**

Ge + MnO2 🡪 GeO + MnO oxidized=\_\_\_**Ge**\_\_ reduced = \_**Mn**\_\_\_

O2 + C 🡪 CO2  oxidized=\_\_**\_C**\_\_\_\_\_\_ reduced = \_\_\_\_**O\_\_\_**

\_\_\_/24

**3.6. Basic Gas Law Calculations (2 pts each/6 pts total)**

**Pressure unit questions here**

1) At constant temperature and gas moles, a piston initially at 6 atm and 1 liter is expanded to 2 liters in volume. What is the new pressure, P2, in the cylinder ?

**P1V1=P2V2**

**6\*1=P2\*2=>P2=6/2=3**

P2= \_\_\_\_\_**3**\_\_\_\_\_\_\_\_\_atm

2) At constant pressure and gas moles, a piston initially at 200 K and 1 liter shrinks to 0.25

liters, What is the new temperature, T2, of the piston?

**V1/T1=V2/T2**

**1/200=0.25/T2=> T2 =50**

T2 =\_\_\_\_\_**50**\_\_\_\_\_\_\_\_\_\_ K

**3.7. Triviata (2 pts)**

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

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

\_\_\_\_\_/8