NAME: _____ Form 1 (blue)

September 17, 2001	QUIZ #1	CHEM 101

1) Fill in the blanks to balance the following equations:

__**2**__$FeTiO_3$ + __**2**__Cl_2 + ____C → __**2**__$FeCl_2$ + __**2**__TiO_2 + ____CO_2

2) Name the following compounds

a) $CaCl_2$ ____**calcium chloride**_____

b) $CuBr_2$ ____**copper(II) bromide**_____

c) N_2F_4 ____**dinitrogen tetrafluoride**_____

3) Mandelic acid is an organic acid composed of carbon (63.15%), hydrogen (5.30%), and oxygen (31.55%) by mass.

a) What is the empirical formula for this compound? **Assume 100 g**

C: (63.15 g C) x (1 mol C/12.011 g C) = 5.258 mol C → 5.258/1.972 = 2.666 = 8/3
H: (5.30 g H) x (1 mol H/1.008 g H) = 5.26 mol H → 5.26/1.972 = 2.667 = 8/3
O: (31.55 g O) x (1 mol O/15.999 g O) = 1.972 mol O → 1.972/1.972 = 1.000 = 1

$C_{8/3}H_{8/3}O$ → need whole numbers so mulitply by 3 → $\underline{C_8H_8O_3}$

b) If the molar mass of the compound is 152.14 g/mol what is the molecular formula of the acid?

Using empirical formula molar mass of $C_8H_8O_3$ = (8 x 12.011 g/mol) + (8 x 1.008 g/mol) + (3 x 15.999 g/mol) = 152.15 g/mol
Molar mass/Emprical molar mass = 152.14/152.15 = 0.99993 = 1

Molecular formula is same as empirical formula, $\underline{C_8H_8O_3}$

4) Ammonia gas can be prepared by the reaction of a metal oxide such as calcium oxide with ammonium chloride by the reaction shown below.

$$CaO + 2NH_4Cl \rightarrow 2NH_3 + H_2O + CaCl_2$$

A reaction takes palce between 112 g of CaO and 224 g of NH_4Cl and goes to completion.

a) What is the limiting reagent (**circle one shown to the right**): **CaO** NH_4Cl
SHOW WORK!!

CaO: 112 g CaO x [1 mol/(40.078 g + 15.999 g)] = 2.00 mol CaO
NH_4Cl: 224 g NH_4Cl x {1 mol/[14.007 g + 4(1.008 g) + 35.453 g]} = 4.19 mol NH_4Cl
Need 2.00 mol CaO x (2 mol NH_4Cl/1 mol CaO) = 4.00 mol NH_4Cl →Have that much
Need 4.19 mol NH_4Cl x (1 mol CaO/2 mol NH_4Cl) = 2.10 mol CaO → Do not have that much
Thus, $\underline{\text{CaO is limiting reagent}}$

b) Calculate the maximum yield of NH_3.

2.00 mol CaO x (2 mol NH_3/1 mol CaO) = 4.00 mol NH_3

4.00 mol NH_3 x {[14.007 g + 3(1.008 g)/1 mol NH_3} = $\underline{\text{68.1 g } NH_3}$

NAME: _____ Form 2 (green)

September 17, 2001	QUIZ #1	CHEM 101

1) Fill in the blanks to balance the following equations:

__**2**__$FeTiO_3$ + __**2**__Cl_2 + ____C → __**2**__$FeCl_2$ + __**2**__TiO_2 + ____CO_2

2) Name the following compounds:

a) $MgBr_2$ **__magesium bromide_____**

a) $FeCl_3$ **___iron(III) chloride_____**

c) N_2H_4 **____dinitrogen tetrahydride_____**

3) Salicylic acid, or aspirin, is 60.87% C, 4.38% H, and 34.65% O by mass.

a) What is the empirical formula for this compound? **Assume 100 g**

C: (60.87 g C) x (1 mol C/12.011 g C) = 5.068 mol C → 5.068/2.166 = 2.340 = 7/3
H: (4.38 g H) x (1 mol H/1.008 g H) = 4.35 mol H → 4.35/2.166 = 2.01 = 2
O: (34.65 g N) x (1 mol O/15.999 g O) = 2.166 mol O → 2.474/2.166 = 1.000 = 1

$C_{7/3}H_2O$ → need whole numbers so mulitply by 3 → $\underline{C_7H_6O_3}$

b) If the molar mass of the compound is 138.12 g/mol what is the molecular formula of the compound?

Using empirical formula molar mass of $C_7H_6O_3$ = (7 x 12.011 g/mol) + (6 x 1.008 g/mol) + (3 x 15.999 g/mol) = 138.12 g/mol
Molar mass/Emprical molar mass = 138.12/138.12 = 1.000 = 1

Molecular formula is same as empirical formula, $\underline{C_7H_6O_3}$

3) Diborane, B_2H_6, is a valuable compound in the synthesis of new organic compounds. One way this compound can be made is by the reaction shown below.

$$2NaBH_4 + I_2 \rightarrow B_2H_6 + 2NaI + H_2$$

A reaction takes place between 1.23 g of $NaBH_4$ and 4.57 g of I_2 and goes to completion.

a) What is the limiting reagent (**circle one shown to the right**): **$\underline{NaBH_4}$** I_2
SHOW WORK!!

$NaBH_4$: 1.23 g $NaBH_4$ x {1 mol/[22.990 g + 10.811 g + 4(1.008 g)]} = 0.0325 mol $NaBH_4$
I_2: 4.57 g I_2 x [1 mol/(2 x 126.904)]= 0.0180 mol I_2
Need 0.0325 $NaBH_4$ x (1 mol I_2/2 mol $NaBH_4$) = 0.0163 mol I_2 →Have that much
Need 0.0180 mol I_2 x (2 mol $NaBH_4$/2 I_2) = 0.0360 mol $NaBH_4$ → Do not have that much
Thus, $\underline{NaBH_4}$ is limiting reagent

b) Calculate the maximum yield of B_2H_6.

0.0325 mol $NaBH_4$ x (1 mol B_2H_6/2 mol $NaBH_4$) = 0.0163 mol B_2H_6

0.0163 mol B_2H_6 x {[(2 x 10.811 g) + (6 x 1.008 g)]/1 mol B_2H_6} = $\underline{0.451\ g\ B_2H_6}$