CHEM UNIT 4 HW 2 — KITCH

1. $2Na + Cl_2 \rightarrow 2NaCl$

$(5\ mol\ Na)\left(\frac{2\ mol\ NaCl}{2\ mol\ Na}\right) = 5\ mol\ NaCl$

2. $2H_2 + O_2 \rightarrow 2H_2O$

a) $(10\ mol\ O_2)\left(\frac{2\ mol\ H_2}{1\ mol\ O_2}\right) = 20\ mol\ H_2$

b) $(15\ mol\ H_2O)\left(\frac{1\ mol\ O_2}{2\ mol\ H_2O}\right) = 7.5\ mol\ O_2$

c) $(15\ mol\ H_2O)\left(\frac{18.02\ g}{mol}\right) = 270.3\ g\ H_2O$

3. $Fe + CuSO_4 \rightarrow Cu + FeSO_4$

$15\ mol\ Fe = ?\ mol\ Cu$

$(15\ mol\ Fe)\left(\frac{1\ mol\ Cu}{1\ mol\ Fe}\right) = 15\ mol\ Cu$

4. $Na_2CO_3 + Ca(OH)_2 \rightarrow 2NaOH + CaCO_3$

$2\ mol\ NaOH = ?\ mol\ Na_2CO_3 \text{ \& } ?\ mol\ Ca(OH)_2$

$(2\ mol\ NaOH)\left(\frac{1\ mol\ Na_2CO_3}{2\ mol\ NaOH}\right) = 1\ mol\ Na_2CO_3$

$(2\ mol\ NaOH)\left(\frac{1\ mol\ Ca(OH)_2}{2\ mol\ NaOH}\right) = 1\ mol\ Ca(OH)_2$

5. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

a) $(4.5\ mol\ C_2H_6)\left(\frac{7\ mol\ O_2}{2\ mol\ C_2H_6}\right) = 15.75\ mol\ O_2$

b) $(4.5\ mol\ C_2H_6)\left(\frac{4\ mol\ CO_2}{2\ mol\ C_2H_6}\right) = 9\ mol\ CO_2$ / $(4.5\ mol\ C_2H_6)\left(\frac{6\ mol\ H_2O}{2\ mol\ C_2H_6}\right) = 13.5$

6. a) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

b) $(.75\ mol\ NaOH)\left(\frac{1\ mol\ H_2SO_4}{2\ mol\ NaOH}\right) = .375\ mol\ H_2SO_4$

$(.375\ mol\ H_2SO_4)\left(\frac{98.03\ g}{mol}\right) = 36.78\ g\ H_2SO_4$

c) $(.75\ mol\ NaOH)\left(\frac{1\ mol\ Na_2SO_4}{2\ mol\ NaOH}\right) = .375\ mol\ Na_2SO_4$

$(2 \cdot 22.99\ g) + (32.06\ g) + (4 \cdot 16\ g) =$

$(.375\ mol\ Na_2SO_4)\left(\frac{142.04\ g}{mol}\right) = 53.27\ g\ Na_2SO_4$

$(.75\ mol\ NaOH)\left(\frac{2\ mol\ H_2O}{2\ mol\ NaOH}\right) = .75\ mol\ H_2O$

$(.75\ mol\ H_2O)\left(\frac{18.02\ g}{mol}\right) = 13.52\ g\ H_2O$

7. a) $2Na + Cl_2 \rightarrow 2NaCl$

b) $(25\ mol\ NaCl)\left(\frac{2\ mol\ Na}{2\ mol\ NaCl}\right) = 25\ mol\ Na$

$(25\ mol\ Na)\left(\frac{22.99\ g}{mol}\right) = 574.75\ g\ Na$

$(25\ mol\ NaCl)\left(\frac{1\ mol\ Cl_2}{2\ mol\ NaCl}\right) = 12.5\ mol\ Cl_2$

$(12.5\ mol\ Cl_2)\left(\frac{70.90\ g}{mol}\right) = 886.25\ g\ Cl_2$

8. a) $Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$

b) $(2.25\,g\,Ag)\left(\frac{1\,mol}{107.87\,g}\right) = .02086\,mol\,Ag$

$(.02086\,mol\,Ag)\left(\frac{1\,mol\,Cu(NO_3)_2}{2\,mol\,Ag}\right) = .01043\,mol\,Cu(NO_3)_2$
$= .01\,mol$

c) $(.02086\,mol\,Ag)\left(\frac{1\,mol\,Cu}{2\,mol\,Ag}\right) = .01043\,mol\,Cu$
$= .01\,mol$

$(.02096\,mol\,Ag)\left(\frac{2\,mol\,AgNO_3}{2\,mol\,Ag}\right) = .02096\,mol\,AgNO_3$
$= .02\,mol$

9. $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

(2.55(2)+3(16.00))

a) $(4000\,g\,Fe_2O_3)\left(\frac{1\,mol}{159.70\,g}\right) = 25.04696\,mol\,Fe_2O_3$

$(25.04696\,mol\,Fe_2O_3)\left(\frac{3\,mol\,CO}{1\,mol\,Fe_2O_3}\right) = 75.14\,mol\,CO$

b) $25.04696\,mol\,Fe_2O_3\left(\frac{2\,mol\,Fe}{1\,mol\,Fe_2O_3}\right) = 50.09\,mol\,Fe$

$(25.04696\,mol\,Fe_2O_3)\left(\frac{3\,mol\,CO_2}{1\,mol\,Fe_2O_3}\right) = 75.14\,mol\,CO_2$

10. $CO + 2H_2 \rightarrow CH_3OH$

a) $(100\ Kg\ CH_3OH)\left(\frac{1000g}{Kg}\right) = 100,000\ g\ CH_3OH$
$= 1 \times 10^5\ g\ CH_3OH$

$(12.01g) + (4 \cdot 1.01g) + (1 \cdot 16g)$

$(1 \times 10^5\ g\ CH_3OH)\left(\frac{1\ mol}{32.05g}\right) = 3120.1248\ mol\ CH_3OH$

$(3120.1248\ mol\ CH_3OH)\left(\frac{1\ mol\ CO}{1\ mol\ CH_3OH}\right) = 3120.12\ mol\ CO$

$(3120.1248\ mol\ CO)(28.01g/mol) = 87,394.70g\ CO$

$(3120.1248\ mol\ CH_3OH)\left(\frac{2\ mol\ H_2}{1\ mol\ CH_3OH}\right) = 6240.25\ mol\ H_2$

$(6240.2496\ mol\ H_2)\left(\frac{2.02g}{mol}\right) = 12605.3g\ H_2$

11. a) $N_2 + O_2 \rightarrow 2NO$
$2NO + O_2 \rightarrow 2NO_2$

b) $(384g\ O_2)\left(\frac{1\ mol}{32g}\right) = 12\ mol\ O_2$

$(12\ mol\ O_2)\left(\frac{2\ mol\ NO_2}{1\ mol\ O_2}\right) = 24\ mol\ NO_2$

$(14.01g) + (2 \cdot 16g)$

$(24\ mol\ NO_2)\left(\frac{46.01g}{mol}\right) = 1104.24g\ NO_2$ →

CH HW 2 (CONT)

$2NO + O_2 \rightarrow 2NO_2$

11. c) $(12\ mol\ O_2)\left(\frac{2\ mol\ NO}{1\ mol\ O_2}\right) = 24\ mol\ NO$

$(24\ mol\ NO)\left(\frac{30.01\ g}{mol}\right) = 720.24\ g\ NO$

12. $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$

12.01
32.00
44.01

a) $(925\ g\ CO_2)\left(\frac{1\ mol}{44.01\ g}\right) = 21.01795\ mol\ CO_2$

$(21.01795\ mol\ CO_2)\left(\frac{2\ mol\ NaOH}{1\ mol\ CO_2}\right) = 42.04\ mol\ NaOH$

b. $(21.01795\ mol\ CO_2)\left(\frac{1\ mol\ Na_2CO_3}{1\ mol\ CO_2}\right) = 21.02\ mol\ Na_2CO_3$

$(21.01795\ mol\ CO_2)\left(\frac{1\ mol\ H_2O}{1\ mol\ CO_2}\right) = 21.02\ mol\ H_2O$

13. $AgNO_3 + NaBr \rightarrow AgBr + NaNO_3$

c) $(4.5\ mol\ AgNO_3)\left(\frac{1\ mol\ NaBr}{1\ mol\ AgNO_3}\right) = 4.5\ mol\ NaBr$

22.99
79.91
102.90

$(4.5\ mol\ NaBr)\left(\frac{102.90\ g}{mol}\right) = 463.05\ g\ NaBr$

b. $(4.5\ mol\ AgNO_3)\left(\frac{1\ mol\ AgBr}{1\ mol\ AgNO_3}\right) = 4.5\ mol\ AgBr$

107.87
79.91
187.78

$(4.5\ mol\ AgBr)\left(\frac{187.78\ g}{mol}\right) = 845.01\ g\ AgBr$

14. $H_2SO_4 + 2NaHCO_3 \rightarrow 2CO_2 + Na_2SO_4 + 2H_2O$

a) $(150\ g\ H_2SO_4)\left(\frac{1\ mol}{98.08\ g}\right) = 1.52936\ mol\ H_2SO_4$

$(1.52936\ mol\ H_2SO_4)\left(\frac{2\ mol\ NaHCO_3}{1\ mol\ H_2SO_4}\right) = 3.05872\ mol\ NaHCO_3$

$= 3.06\ mol\ NaHCO_3$

b) $(1.52936\ mol\ H_2SO_4)\left(\frac{2\ mol\ CO_2}{1\ mol\ H_2SO_4}\right) = 3.06\ mol\ CO_2$

12.01
32.00
44.01 g

$(1.52936\ mol\ H_2SO_4)\left(\frac{1\ mol\ Na_2SO_4}{1\ mol\ H_2SO_4}\right) = 1.53\ mol\ Na_2SO_4$

45.98
+ 32.06
64.00
142.04

$(1.52936\ mol\ H_2SO_4)\left(\frac{2\ mol\ H_2O}{1\ mol\ H_2SO_4}\right) = 3.06\ mol\ H_2O$

$(3.06\ mol\ CO_2)\left(\frac{44.01\ g}{mol}\right) = 134.67\ g\ CO_2$

$(1.53\ mol\ Na_2SO_4)\left(\frac{142.04\ g}{mol}\right) = 217.32\ g\ Na_2SO_4$

$(3.06\ mol\ H_2O)\left(\frac{18.02\ g}{mol}\right) = 55.14\ g\ H_2O$