Stoichiometry Wkst #3

1. $2\,Bi(ClO_3)_5 \rightarrow 15\,O_2 + 2\,BiCl_5$

$$42\,g\,Bi(ClO_3)_5 \left|\frac{1\,mol\,Bi(ClO_3)_5}{626.23\,g}\right|\frac{15\,mol\,O_2}{2\,mol\,Bi(ClO_3)_5}\left|\frac{32.00\,g\,O_2}{1\,mol\,O_2}\right. = 16\,g\,O_2$$

2. $2\,H_3PO_4(aq) + 3\,Mg(s) \rightarrow 3\,H_2(g) + 1\,Mg_3(PO_4)_2(aq)$

$$16\,g\,Mg \left|\frac{1\,mol\,Mg}{24.31\,g\,Mg}\right|\frac{2\,mol\,H_3PO_4}{3\,mol\,Mg}\left|\frac{98\,g\,H_3PO_4}{1\,mol\,H_3PO_4}\right. = 43\,g\,H_3PO_4$$

3. $1\,Na_2CO_3 + 1\,H_2SO_4 \rightarrow 1\,CO_2 + 1\,Na_2SO_4 + 1\,H_2O$

$$45\,g\,Na_2CO_3 \left|\frac{1\,mol\,Na_2CO_3}{105.99\,g}\right|\frac{1\,mol\,CO_2}{1\,mol\,Na_2CO_3}\left|\frac{22.4\,\ell\,CO_2}{1\,mol\,CO_2}\right. = 9.5\,\ell\,CO_2$$

4. $1\,Cu(OH)_2 \xrightarrow{heat} 1\,CuO + 1\,H_2O$

(48.9g)

$$60\,g\,Cu(OH)_2 \left|\frac{1\,mol\,Cu(OH)_2}{97.57\,g\,Cu(OH)_2}\right|\frac{1\,mol\,CuO}{1\,mol\,Cu(OH)_2}\left|\frac{79.55\,g\,CuO}{1\,mol\,CuO}\right. = 50\,g\,CuO$$

5. $2\,Na_3(PO_4) + 3\,Ca(OH)_2 \rightarrow 1\,Ca_3(PO_4)_2 + 6\,NaOH$

$$25\,g\,Na_3PO_4 \left|\frac{1\,mol\,Na_3PO_4}{163.94\,g}\right|\frac{1\,mol\,Ca_3(PO_4)_2}{2\,mol\,Na_3PO_4}\left|\frac{310.18\,g\,Ca_3(PO_4)_2}{1\,mol\,Ca_3(PO_4)_2}\right. = 24\,g\,Ca_3(PO_4)_2$$

6. $\underline{1}\ Pb_{(s)} + \underline{4}\ HCl_{(aq)} \rightarrow \underline{2}\ H_{2(g)} + \underline{1}\ PbCl_{4\ (aq)}$

$$\frac{140\text{g Pb}}{} \left| \frac{1\text{ mol Pb}}{207.2\text{g Pb}} \right| \frac{2\text{ mol } H_2}{1\text{ mol Pb}} \left| \frac{6.02\times10^{23}\text{ molec } H_2}{1\text{ mol } H_2} \right. = \underline{8.1\times10^{23}\text{ molecules } H_2}$$

7. $\underline{3}\ H_{2\,(g)} + \underline{1}\ N_{2(g)} \rightarrow \underline{2}\ NH_{3\,(g)}$

$$\frac{42\text{ l } N_2}{} \left| \frac{1\text{ mol } N_2}{22.4\text{ l } N_2} \right| \frac{3\text{ mol } H_2}{1\text{ mol } N_2} \left| \frac{22.4\text{ l } H_2}{1\text{ mol } H_2} \right. = 126\text{l} = \underline{130\text{ l } H_2}$$

8. $\underline{2}\ Na_{(s)} + \underline{2}\ H_2O_{(l)} \rightarrow \underline{1}\ H_{2(g)} + \underline{2}\ NaOH_{(aq)}$

$$\frac{15\text{g } H_2O}{} \left| \frac{1\text{ mol } H_2O}{18.02\text{g } H_2O} \right| \frac{2\text{ mol Na}}{2\text{ mol } H_2O} \left| \frac{22.99\text{g Na}}{1\text{ mol Na}} \right. = \underline{19\text{g Na}}$$

9. $\underline{2}\ NaOH + \underline{1}\ BaCl_2 \rightarrow \underline{1}\ Ba(OH)_2 + \underline{2}\ NaCl$

$$\frac{50\text{g NaOH}}{} \left| \frac{1\text{ mol NaOH}}{40.00\text{g NaOH}} \right| \frac{1\text{ mol } Ba(OH)_2}{2\text{ mol NaOH}} \left| \frac{171.35\text{g } Ba(OH)_2}{1\text{ mol } Ba(OH)_2} \right. = 107\text{g} = \underline{100\text{g } Ba(OH)_2}$$

10. $\underline{4}\ Al_{(s)} + \underline{3}\ O_{2(g)} \rightarrow \underline{2}\ Al_2O_3$

$$\frac{15\text{l } O_2}{} \left| \frac{1\text{ mol } O_2}{22.4\text{l } O_2} \right| \frac{4\text{ mol Al}}{3\text{ mol } O_2} \left| \frac{26.98\text{g Al}}{1\text{ mol Al}} \right. = \underline{24\text{g Al}}$$

11. $1\,Zn_{(s)} + 2\,HCl_{(aq)} \rightarrow 1\,H_{2(g)} + 1\,ZnCl_{2(aq)}$

$$5.1\times10^{24}\ \text{molec. } H_2 \left|\frac{1\ \text{mol } H_2}{6.02\times10^{23}\ \text{molec.}}\right|\frac{1\ \text{mol Zn}}{1\ \text{mol } H_2}\left|\frac{65.39\ \text{g Zn}}{1\ \text{mol Zn}}\right| = 550\ \text{g Zn}$$

12. $1\,Pb(ClO_3)_4 \xrightarrow{\text{heat}} 6\,O_2 + 1\,PbCl_4$

$$75\ \text{g } Pb(ClO_3)_4 \left|\frac{1\ \text{mol } Pb(ClO_3)_4}{541\ \text{g } Pb(ClO_3)_4}\right|\frac{6\ \text{mol } O_2}{1\ \text{mol } Pb(ClO_3)_4}\left|\frac{22.4\ \ell\ O_2}{1\ \text{mol } O_2}\right| = \frac{18.63}{\ell\ O_2} = 19\ \ell\ O_2$$

13. $2\,FeF_3 \xrightarrow{\text{electricity}} 2\,Fe + 3\,F_2$

$$35\ \text{g } FeF_3 \left|\frac{1\ \text{mol } FeF_3}{112.85\ \text{g } FeF_3}\right|\frac{3\ \text{mol } F_2}{2\ \text{mol } FeF_3}\left|\frac{22.4\ \ell\ F_2}{1\ \text{mol } F_2}\right| = 10.4\ \ell\ F_2 = 1.0\times10^{1}\ \ell F_2$$

14. $1\,Fe_4[Fe(CN)_6]_3 + 3\,Sn(OH)_4 \rightarrow 3\,SnFe(CN)_6 + 4\,Fe(OH)_3$

$$125\ \text{g } Fe(OH)_3 \left|\frac{1\ \text{mol } Fe(OH)_3}{106.88\ \text{g } Fe(OH)_3}\right|\frac{1\ \text{mol } Fe_4[Fe(CN)_6]_3}{4\ \text{mol } Fe(OH)_3}\left|\frac{859.31\ \text{g } Fe_4[Fe(CN)_6]_3}{1\ \text{mol } Fe_4[Fe(CN)_6]_3}\right| = 250\ \text{g}$$

15. $1\,H_2SO_3 \xrightarrow{\text{heat}} 1\,H_2O + 1\,SO_2$

$$15\ \text{g } H_2SO_3 \left|\frac{1\ \text{mol } H_2SO_3}{82.09\ \text{g } H_2SO_3}\right|\frac{1\ \text{mol } SO_2}{1\ \text{mol } H_2SO_3}\left|\frac{22.4\ \ell\ SO_2}{1\ \text{mol } SO_2}\right| = 4.1\ \ell\ SO_2$$