Station # 1

a) $M_{(NH_4)_2SO_4} = 2(14.007) + 8(1.008) + 32.065 + 4(15.999)$

$= 132.139 \frac{g}{mol}$

b) $M_{Ca_3[Co(CO_3)_3]_2} = 3(40.078) + 2(58.933) + 6(12.011) + 18(15.999)$

$= 598.148 \frac{g}{mol}$

Station # 2

a) $N_{CH_4} = 8.50\ mol \times 6.022 \times 10^{23} \frac{molecules}{mol}$

$= 5.12 \times 10^{24}\ molecules$

b) $m_{C_7H_6O_2} = 1.50 \times 10^{24}\ molecules \times \frac{1\ mol}{6.022 \times 10^{23}\ molecules} \times \frac{122.123\ g}{mol}$

$= 304\ g$

$M_{C_7H_6O_2} = 7(12.011) + 6(1.008) + 2(15.999)$

$= 122.123 \frac{g}{mol}$

Station # 3

$\underline{8}\ H_2 + \underline{\quad}\ S_8 \rightarrow \underline{8}\ H_2S$

a. 1. $\frac{H_2}{H_2S}$ $\frac{8\ mol\ H_2}{8\ mol\ H_2S}$ 2. $\frac{H_2}{S_8}$ $\frac{8\ mol\ H_2}{1\ mol\ S_8}$

b. $n_{H_2S} = 20\ mol\ H_2 \times \frac{8\ mol\ H_2S}{8\ mol\ H_2}$

$= 20\ mol\ H_2S$

c. $n_{H_2S} = 20\ mol\ S_8 \times \frac{8\ mol\ H_2S}{1\ mol\ S_8}$

$= 160\ mol$

Station # 4.

$$\underset{12.00\ mol}{2}\ KClO_3 \rightarrow \underline{2}\ KCl + \underset{?}{\underline{3}}\ O_2$$

$$n_{O_2} = 12.00\ mol\ KClO_3 \times \frac{3\ mol\ O_2}{2\ mol}$$

$$= 18.00\ mol\ O_2$$

Station # 5

a. $\underset{?}{Cu_{(s)}} + \underset{3.50\ mol}{2AgNO_{3\,(aq)}} \rightarrow 2Ag_{(s)} + Cu(NO_3)_{2\,(aq)}$

b. $$n_{Cu} = 3.50\ mol\ AgNO_3 \times \frac{1\ mol\ Cu}{2\ mol\ AgNO_3}$$

$$= 1.75\ mol$$

c. $\underset{?}{Cu_{(s)}} + 2AgNO_{3\,(aq)} \rightarrow \underset{89.5\ g}{2Ag_{(s)}} + Cu(NO_3)_{2\,(aq)}$

$63.546\ \frac{g}{mol}$ $\qquad$ $107.868\ \frac{g}{mol}$

$$m_{Cu} = 89.5\ \cancel{g_{Ag}} \times \frac{1\ mol\ Ag}{107.868\ \cancel{g_{Ag}}} \times \frac{1\ \overset{mol}{Cu}}{2\ mol\ Ag} \times \frac{63.546\ g\ Cu}{mol\ Cu}$$

$$= 26.4\ g$$

Station #6

$$\underset{2.50\ g}{\underset{39.098\ \frac{g}{mol}}{2K_{(s)}}} + Cl_{2\,(g)} \rightarrow \underset{N = ?}{2KCl_{(s)}}$$

a. $$N_{KCl} = 2.50\ \cancel{g_K} \times \frac{1\ mol\ \cancel{K}}{39.098\ \cancel{g_K}} \times \frac{2\ mol\ KCl}{2\ mol\ \cancel{K}} \times \frac{6.022 \times 10^{23}\ formula\ units}{mol\ KCl}$$

$$= 3.85 \times 10^{22}\ formula\ units$$

b $N_{atoms} = 2(3.85 \times 10^{22}) = 7.70 \times 10^{22}\ atoms$ $\qquad$ $KCl \rightarrow 2\ atoms$

station # 7

a) $M_{Fe(C_5H_5)_2} = 55.845 + 10(12.011) + 10(1.008)$

$= 186.035 \frac{g}{mol}$

$\% Fe = \frac{55.845}{186.035} \times 100$ $\% C = \frac{10(12.011)}{186.035} \times 100$ $\% H = \frac{10(1.008)}{186.035} \times 100$

$= 30.0\ \%$ $= 64.6\ \%$ $= 5.42\ \%$

b) Assume 100g sample

$m_C = 67.9g$ $m_H = 5.7g$ $m_N = 26.4g$

$n_C = 67.9g \times \frac{1mol}{12.011g}$ $n_H = 5.7g \times \frac{1mol}{1.008g}$ $n_N = 26.4g \times \frac{1mol}{14.007g}$

$= 5.653\ mol$ $= 5.655\ mol$ $= 1.885\ mol$

C : H : N

$\frac{5.653}{1.885} : \frac{5.655}{1.885} : \frac{1.885}{1.885}$

3 : 3 : 1

∴ the empirical formula is C_3H_3N

Station # 8

Assume 100g sample

$m_{Li} = 18.7g$ $m_C = 16.3g$ $m_O = 65.0g$

$n_{Li} = 18.7g \times \frac{1mol}{6.941g}$ $n_C = 16.3g \times \frac{1mol}{12.011g}$ $n_O = 65.0g \times \frac{1mol}{15.999}$

$= 2.694\ mol$ $= 1.357\ mol$ $= 4.063\ mol$

Li : C : O

$\frac{2.694\ mol}{1.357} : \frac{1.357}{1.357} : \frac{4.063}{1.357}$

2 : 1 : 3

∴ the empirical is Li_2CO_3

$M\ Li_2CO_3 = 2(6.941) + 12.011 + 3(15.999)$

$= 73.890\ \frac{g}{mol}$

$\text{molecular multiplier} = \frac{73.8\ \frac{g}{mol}}{73.890\ \frac{g}{mol}}$

$= 1$

∴ the molecular formula is Li_2CO_3

station # 9

a. $Zn(s) + 2HCl(aq) \longrightarrow H_2(g) + ZnCl_2(aq)$

b. m: 9.25 g, 22.6 g, ?

M: $65.409\ \frac{g}{mol}$, $36.461\ \frac{g}{mol}$, $136.315\ \frac{g}{mol}$

n: $\frac{0.1414\ mol}{1}$, $\frac{0.6198\ mol}{2}$

0.1414, 0.3099

↑ LR (smaller #)

c. $m_{ZnCl_2} = 0.1414\ mol\ Zn \times \frac{1\ mol\ ZnCl_2}{1\ mol\ Zn} \times \frac{136.315\ g\ ZnCl_2}{1\ mol\ ZnCl_2}$

$= 19.3\ g$

Station #10

$$4\,Al_{(s)} + 3O_{2(g)} \longrightarrow 2Al_2O_{3(s)}$$

m	81.0 g	excess	106 g actual ?
M	26.982 g/mol		101.961 g/mol

$$m_{Al_2O_3} = 81.0\,\cancel{g\,Al} \times \frac{1\,mol\,\cancel{Al}}{26.982\,\cancel{g\,Al}} \times \frac{2\,mol\,\cancel{Al_2O_3}}{4\,mol\,\cancel{Al}} \times \frac{101.961\,g\,Al_2O_3}{1\,mol\,\cancel{Al_2O_3}}$$

$$= 153\,g$$