

ex 1) Given: ^{63}Cu MASS = 62.93 u
 ^{65}Cu MASS = 64.93 u

Find: Average Mass

$$\left(\frac{69.09 \text{ Atoms}}{1}\right) \left(\frac{62.93 \text{ u}}{\text{Atom}}\right) + \left(\frac{30.91 \text{ Atoms}}{1}\right) \left(\frac{64.93 \text{ u}}{\text{Atom}}\right) = 6355 \text{ u}$$

Average MASS $\frac{6355 \text{ u}}{100 \text{ Atoms}} = \boxed{63.55 \text{ u/Atom}}$

ex 2/ Given: 6 Atoms of Am Atomic MASS 243g
Find: ? g

$$\left(\frac{6 \text{ Atoms Am}}{1}\right) \left(\frac{1 \text{ mole Am}}{6.022 \times 10^{23} \text{ Atoms Am}}\right) \left(\frac{243 \text{ g Am}}{1 \text{ mole Am}}\right) = \boxed{2.42 \times 10^{-21} \text{ g Am}}$$

ex 3/ Given: Al 10.0g
Find: ? moles Al
 ? number Atoms

Soln:

$$\left(\frac{10.0 \text{ g Al}}{1}\right) \left(\frac{1 \text{ mole Al}}{26.98 \text{ g Al}}\right) = \boxed{.371 \text{ mole Al}}$$

$$\left(\frac{.371 \text{ mole Al}}{1}\right) \left(\frac{6.022 \times 10^{23} \text{ Atoms Al}}{1 \text{ mole Al}}\right)$$

$$= \boxed{2.23 \times 10^{23} \text{ Atoms Al}}$$

ex 4/ Given: Co 5.00×10^{20} Atoms

Find: ? moles ? g

Soln: $\left(\frac{5.00 \times 10^{20} \text{ Atoms Co}}{1}\right) \left(\frac{1 \text{ mole Co}}{6.022 \times 10^{23} \text{ Atoms Co}}\right) = \boxed{8.30 \times 10^{-4} \text{ moles Co}}$

$$\left(\frac{8.30 \times 10^{-4} \text{ moles Co}}{1}\right) \left(\frac{58.93 \text{ g Co}}{1 \text{ mole Co}}\right) = \boxed{.0489 \text{ g Co}}$$

ex 5 / Given: $C_{10}H_6O_3$

Find: A) ? molar mass

B) $1.56 \times 10^{-2} g C_{10}H_6O_3$
? moles

Soln: A)

$$C \quad 10 \times 12.01g = 120.1g$$

$$H \quad 6 \times 1.008g = 6.048g$$

$$O \quad 3 \times 16.00g = 48.00$$

$$\downarrow$$

$$174.148$$

$$\boxed{174.1g C_{10}H_6O_3}$$

B)

$$\left(\frac{1.56 \times 10^{-2} g C_{10}H_6O_3}{1} \right) \left(\frac{1 \text{ mole } C_{10}H_6O_3}{174.1g C_{10}H_6O_3} \right) = \boxed{8.96 \times 10^{-5} \text{ moles } C_{10}H_6O_3}$$

ex 6 / Given: $CaCO_3$

Find: A) ? molar mass (MM)

B) 4.86 moles $CaCO_3$

? g $CaCO_3$? g CO_3^{2-} IONS

Soln:

$$Ca \quad 1 \times 40.08g = 40.08g$$

$$C \quad 1 \times 12.01g = 12.01g$$

$$O \quad 3 \times 16.00g = 48.00g$$

$$\boxed{100.09g CaCO_3}$$

$$\left(\frac{4.86 \text{ moles } CaCO_3}{1} \right) \left(\frac{100.09g CaCO_3}{1 \text{ mole } CaCO_3} \right) = \boxed{486g CaCO_3}$$

$$\left(\frac{4.86 \text{ moles } CaCO_3}{1} \right) \left(\frac{1 \text{ mole } CO_3^{2-}}{1 \text{ mole } CaCO_3} \right) \left(\frac{60.01g CO_3^{2-}}{1 \text{ mole } CO_3^{2-}} \right) = \boxed{292g CO_3^{2-}}$$

ex 7 / Given: $1 \times 10^{-6} g C_7H_{14}O_2$

Find: A) ? molecules $C_7H_{14}O_2$ B) ? of C atoms

Soln:

$$\text{A) } \left(\frac{1 \times 10^{-6} g C_7H_{14}O_2}{1} \right) \left(\frac{1 \text{ mole } C_7H_{14}O_2}{130.18g C_7H_{14}O_2} \right) \left(\frac{6.022 \times 10^{23} \text{ molecules } C_7H_{14}O_2}{1 \text{ mole } C_7H_{14}O_2} \right) = \boxed{5 \times 10^{15} \text{ molecules } C_7H_{14}O_2}$$

$$\text{B) } \left(\frac{1 \times 10^{-6} g C_7H_{14}O_2}{1} \right) \left(\frac{1 \text{ mole } C_7H_{14}O_2}{130.18g C_7H_{14}O_2} \right) \left(\frac{7 \text{ moles } C}{1 \text{ mole } C_7H_{14}O_2} \right) \left(\frac{6.022 \times 10^{23} \text{ atoms } C}{1 \text{ mole } C} \right) = \boxed{3 \times 10^{16} \text{ atoms } C}$$

$$C \quad 7 \times 12.01 = 84.07$$

$$H \quad 14 \times 1.008 = 14.112$$

$$O \quad 2 \times 16.00 = 32.00$$

$$\underline{130.18}$$

ex 8/ Given: $C_{10}H_{14}O$ Find: ? mass % of each elementSoln:

$$C \quad 10 \times 12.01g = 120.1g$$

$$H \quad 14 \times 1.008g = 14.11g$$

$$O \quad 1 \times 16.00g = \frac{16.00g}{150.2g}$$

$$C = \frac{120.1g}{150.2g} \times 100 = 79.96\% C$$

$$H = \frac{14.11g}{150.2g} \times 100 = 9.394\% H$$

$$O = \frac{16.00g}{150.2g} \times 100 = 10.65\% O$$

ex 9/ Given: $C_{14}H_{20}N_2SO_4$ Find: ? mass % each elementSoln:

$$C \quad 14 \times 12.01g = 168.1g$$

$$H \quad 20 \times 1.008g = 20.16g$$

$$N \quad 2 \times 14.01g = 28.02g$$

$$S \quad 1 \times 32.06g = 32.06g$$

$$O \quad 4 \times 16.00g = 64.00g$$

$$312.34 \Rightarrow 312.3g$$

$$\frac{168.1g}{312.3g} \times 100 = 53.83\% C$$

$$\frac{20.16g}{312.3g} \times 100 = 6.453\% H$$

$$\frac{28.02g}{312.3g} \times 100 = 8.972\% N$$

$$\frac{32.06g}{312.3g} \times 100 = 10.27\% S$$

$$\frac{64.00g}{312.3g} \times 100 = 20.49\% O$$

ex 10/ Given: 71.65% Cl, 24.27% C, 4.07% H

molar mass = 98.96g/mol

Find: empirical + molecular formulas

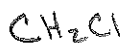
$$\text{Soln: } \left(\frac{71.65g Cl}{1} \right) \left(\frac{1 \text{ mole Cl}}{35.45g Cl} \right) = 2.021 \text{ mole Cl} \quad \begin{array}{l} \text{Div by smallest ratio} \\ / 2.021 \therefore Cl \end{array}$$

$$\left(\frac{24.27g C}{1} \right) \left(\frac{1 \text{ mole C}}{12.01g C} \right) = 2.021 \text{ mole C} \quad / 2.021 \therefore C$$

$$\left(\frac{4.07g H}{1} \right) \left(\frac{1 \text{ mole H}}{1.008g H} \right) = 4.04 \text{ mole H} \quad / 2.021 \therefore H_2$$



ex 10 conti



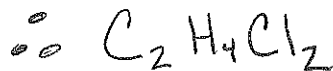
$$C \ 1 \times 12.01 = 12.01g \ C$$

$$H \ 2 \times 1.008g = 2.016g \ H$$

$$Cl \ 1 \times 35.45g = 35.45g \ Cl$$

$$\frac{49.48g \ CH_2Cl}{49.48g \ CH_2Cl}$$

$$\frac{98.96g}{49.48g} = 2$$

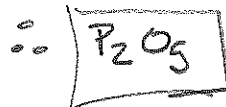


ex 11 / given: 43.64% P, 56.36% O molar mass = 283.88 g/mole
 Find: Empirical & molecular Formula's

Soln:

$$\left(\frac{43.64g \ P}{1} \right) \left(\frac{1 \text{ mole } P}{30.97g \ P} \right) = 1.409 \text{ mole } P \quad / 1.409 = 1 \text{ mole } P$$

$$\left(\frac{56.36g \ O}{1} \right) \left(\frac{1 \text{ mole } O}{16.00g \ O} \right) = 3.523 \text{ mole } O \quad / 1.409 = 2.5 \text{ mole } O$$

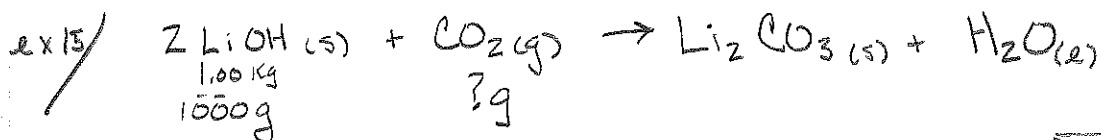
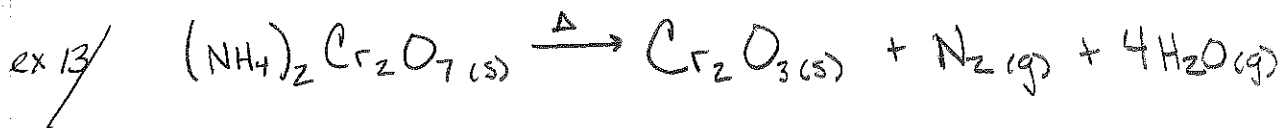
mmol P₂O₅

$$P \ 2 \times 30.97g = 61.94g \ P$$

$$O \ 5 \times 16.00g = 80.00g \ O$$

$$\frac{141.94g \ P_2O_5}{141.94g \ P_2O_5}$$

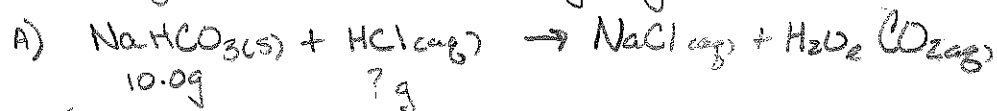
$$\frac{283.88g}{141.94g} = 2$$



$$\left(\frac{1000g \ LiOH}{1} \right) \left(\frac{1 \text{ mole } LiOH}{23.95g \ LiOH} \right) \left(\frac{1 \text{ mole } CO_2}{2 \text{ mole } LiOH} \right) \left(\frac{44.01g \ CO_2}{1 \text{ mole } CO_2} \right) = \boxed{919g \ CO_2}$$

ex 16/ Find: most effective Antacid per gram?

10.0g $\text{NaHCO}_3(s)$ vs 10.0g $\text{Mg(OH)}_2(s)$



$$\left(\frac{10.0g \text{ NaHCO}_3}{1} \right) \left(\frac{1 \text{ mole NaHCO}_3}{84.01g \text{ NaHCO}_3} \right) \left(\frac{1 \text{ mole HCl}}{1 \text{ mole NaHCO}_3} \right) \left(\frac{36.46g \text{ HCl}}{1 \text{ mole HCl}} \right) = 4.34g \text{ HCl}$$

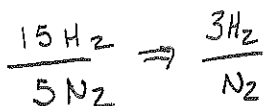


$$\left(\frac{10.0g \text{ Mg(OH)}_2}{1} \right) \left(\frac{1 \text{ mole Mg(OH)}_2}{58.32g \text{ Mg(OH)}_2} \right) \left(\frac{2 \text{ mole HCl}}{1 \text{ mole Mg(OH)}_2} \right) \left(\frac{36.46g \text{ HCl}}{1 \text{ mole HCl}} \right) = 12.5g \text{ HCl}$$

Mg(OH)_2 neutralizes almost 3x HCl as NaHCO_3

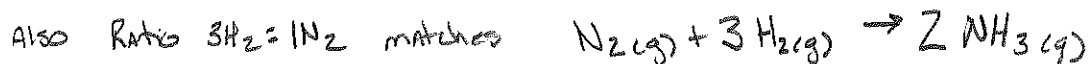
ex 17/ Situation 1

Before



After

yields complete rxn



Situation 2

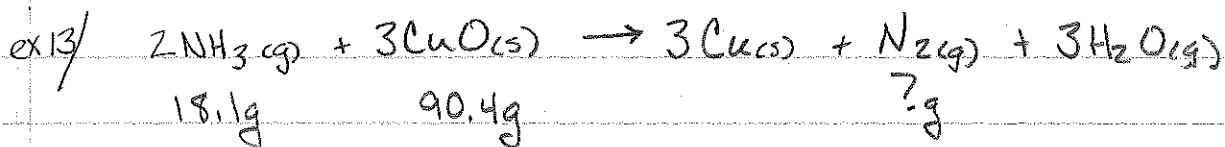
Before



After

yields excess amount of N_2

$\therefore \text{H}_2$ is limiting



(1st) Ag to moles

$$\left(\frac{18.1\text{g NH}_3}{1}\right)\left(\frac{1\text{mole NH}_3}{17.03\text{g NH}_3}\right) = 1.06\text{ NH}_3$$

$$\left(\frac{90.4\text{g CuO}}{1}\right)\left(\frac{1\text{mole CuO}}{79.55\text{g CuO}}\right) = 1.14\text{ mole CuO}$$

2nd Table

(3) solve for X

	2NH ₃	3CuO	N ₂		
I	1.06m	1.14m	0	NH ₃	1.06 - 2x = 0 X = .530
C	-2x	-3x	x	CuO	1.14 - 3x = 0 X = .380
				↑	limiting
	-2(.380) = -.76	-3(.380) = -1.14	.380		

E	.30M	0	.380
	Excess	Limiting	Produced

CuO Limiting

$$\left(\frac{.380\text{N}_2}{1}\right)\left(\frac{28.02\text{g N}_2}{1\text{mole N}_2}\right) = 10.6\text{N}_2$$

ex 19/



68.5 kg

8.60 kg

? g

← Also Theoretical yield

3.75×10^4 g Actual yield

$$\left(\frac{68.5 \text{ kg Co}}{1}\right) \left(\frac{1000 \text{ g}}{1 \text{ kg}}\right) \left(\frac{1 \text{ mole Co}}{28.01 \text{ g Co}}\right) = 2450 \text{ mole Co} \quad ? \% \text{ yield}$$

$$\left(\frac{8.60 \text{ kg H}_2}{1}\right) \left(\frac{1000 \text{ g}}{1 \text{ kg}}\right) \left(\frac{1 \text{ mole H}_2}{2.016 \text{ g H}_2}\right) = 4270 \text{ mole H}_2$$

	Co	2 H ₂	CH ₃ OH	
I	2450 mole	4270 mole	0	Co $2450 - x = 0$
C	-1x	-2x	x	$x = 2450$
	-2140 M	-2(2140) = -4280 M	2140 M	H ₂ $4270 - 2x = 0$
	310 M	∅	2140 M	$x = 2140$
	Excess	Limiting	Produced	

↓
12.01
3.024
16.00
1.008

32.042
↑

$$\left(\frac{2140 \text{ mole CH}_3\text{OH}}{1}\right) \left(\frac{32.04 \text{ g CH}_3\text{OH}}{1 \text{ mole CH}_3\text{OH}}\right) = 68600 \text{ g or } 6.86 \times 10^4 \text{ g CH}_3\text{OH}$$

$$\frac{\text{Actual}}{\text{Theor}} \times 100 \Rightarrow \frac{3.75 \times 10^4 \text{ g CH}_3\text{OH}}{6.86 \times 10^4 \text{ g CH}_3\text{OH}} \times 100 = 52.0\% \text{ yield CH}_3\text{OH}$$