

Resolución de problemas de reacciones químicas

① a) 2, 3, 2, 2

b) 4, 1, 2, 2

c) 4, 1, 1, 1, 2

d) 2, 1, 1, 2

e) 2, 1, 2, 1

f) 1, 5, 3, 4

② a) 1, 1, 2

b) 2, 3, 2, 2

c) 2, 1, 3, 3

d) 2, 15, 10, 10

e) 2, 3, 1, 3, 3

f) 3, 2, 1, 3

③ a) 1, 2, 2, 1

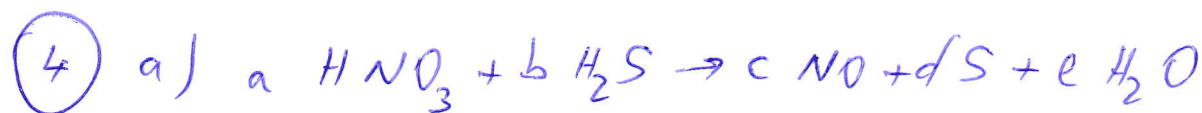
b) 4, 3, 2, 6

c) 2, 1, 3, 2

d) 2, 3, 1, 6

e) 3, 2, 1

f) 1, 6, 2, 3



$$\text{H: } a + 2b = 2e' \quad \left| \quad 1 + 2b = 4 \quad \left| \quad a = 1 \xrightarrow{\times 2} 2 \right.$$

$$\text{N: } a = c'$$

$$2b = 3$$

$$b = 3/2 \rightarrow 3$$

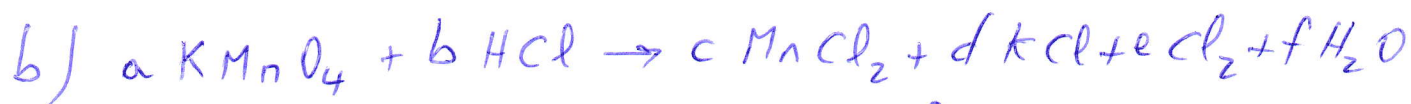
$$\text{O: } 3a = c + e'$$

$$c = 1 \rightarrow 2$$

$$\text{S: } b = d$$

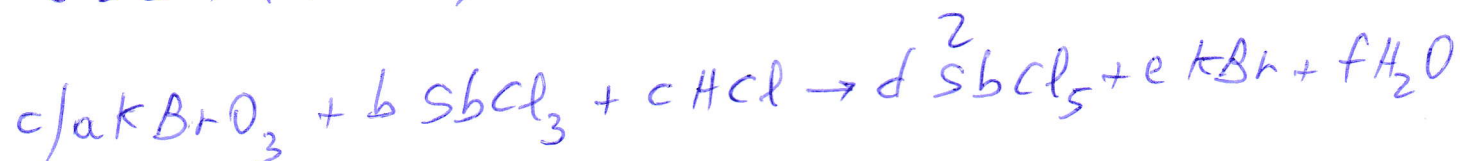
$$d = 3/2 \rightarrow 3$$

$$e = 2 \rightarrow 4$$



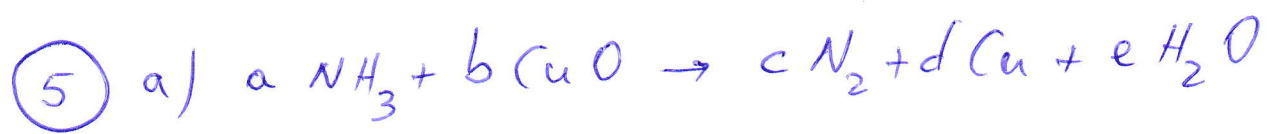
K: $a = d$ ✓	$a = 1 \xrightarrow{\times 2} 2$
Mn: $a = c$ ✓	$b = 8 \rightarrow 16$
O: $4a = f$ ✓	$c = 1 \rightarrow 2$
H: $b = 2f$ ✓	$d = 1 \rightarrow 2$
Cl: $b = 2c + d + 2e$	$e = 5/2 \rightarrow 5$
	$f = 4 \rightarrow 8$

$$8 = 2 + 1 + 2e \Rightarrow 5 = 2e \Rightarrow e = \frac{5}{2}$$

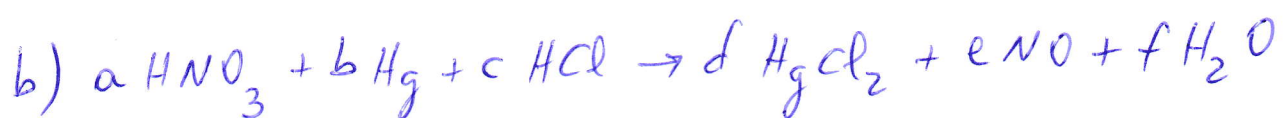


K: $a = e$ ✓	$a = 1$
Br: $a = e$ ✓	$b = 3$
O: $3a = f$ ✓	$c = 6$
Sb: $b = d$ ✓	$d = 3$
Cl: $3b + c = 5d$ ✓	$e = 1$
H: $c = 2f$ ✓	$f = 3$

$$3b + 6 = 5b \Rightarrow 6 = 2b \Rightarrow b = 3$$

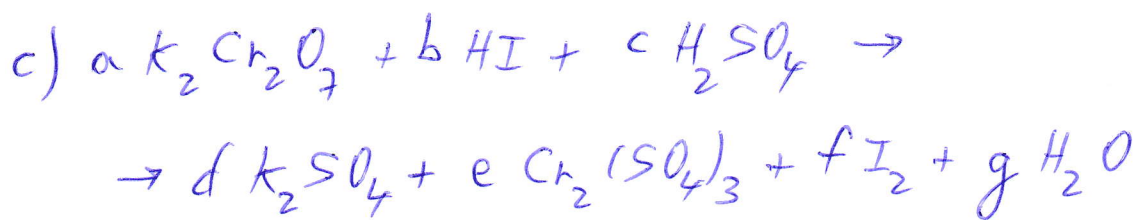


$$\begin{array}{l|l}
 \text{N: } a = 2c \checkmark & a = 1 \rightarrow 2 \\
 \text{H: } 3a = 2e \checkmark & b = 3/2 \rightarrow 3 \\
 \text{Cu: } b = d & c = 1/2 \rightarrow 1 \\
 \text{O: } b = e & d = 3/2 \rightarrow 3 \\
 & e = 3/2 \rightarrow 3
 \end{array}$$



$$\begin{array}{l|l}
 \text{H: } a + c = 2f \checkmark & a = 1 \xrightarrow{\times 2} 2 \\
 \text{N: } a = e \checkmark & b = 3/2 \rightarrow 3 \\
 \text{O: } 3a = e + f \checkmark & c = 3 \rightarrow 6 \\
 \text{Hg: } b = d \checkmark & d = 3/2 \rightarrow 3 \\
 \text{Cl: } c = 2d \checkmark & e = 1 \rightarrow 2 \\
 & f = 2 \rightarrow 4
 \end{array}$$

$$1 + c = 4$$



$$\begin{array}{l|l} K: & 2a = 2d \\ Cr: & 2a = 2e \\ O: & 7a + 4c = 4d + 12e + g \\ H: & b + 2c = 2g \\ I: & b = 2f \\ S: & c = d + 3e \end{array} \quad \begin{array}{l} a = 1 \\ b = 6 \\ c = 4 \\ d = 1 \\ e = 1 \\ f = 3 \\ g = 7 \end{array}$$

$$7 + 16 = 4 + 12 + g \Rightarrow 23 = 16 + g \Rightarrow g = 7$$

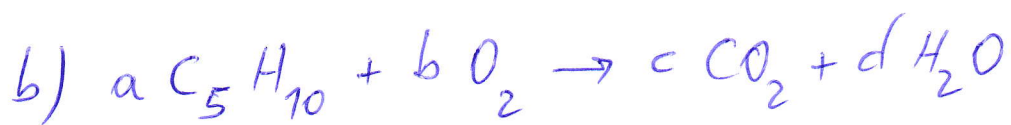
$$b + 8 = 14$$



$$\begin{array}{l|l} H: & a = 2e \\ N: & a = d \\ O: & 3a = 4c + 2d + e \\ Pb: & b = c \\ S: & b = c \end{array} \quad \begin{array}{l} a = 1 \xrightarrow{\times 8} 8 \\ b = 1/8 \rightarrow 1 \\ c = 1/8 \rightarrow 1 \\ d = 1 \rightarrow 8 \\ e = 1/2 \rightarrow 4 \end{array}$$

$$3 = 4c + 2 + \frac{1}{2} \Rightarrow \frac{1}{2} = 4c$$

(4)



$$\begin{array}{l|l} C: 5a = c \checkmark & a = 1 \xrightarrow{\times 2} 2 \\ H: 10a = 2d \checkmark & b = 15/2 \rightarrow 15 \\ O: 2b = 2c + d & c = 5 \rightarrow 10 \\ & d = 5 \rightarrow 10 \end{array}$$

$$2b = 10 + 5$$

$$\textcircled{7} \quad m_A + m_B = m_C + m_D \Rightarrow$$

$$\Rightarrow 200 + 150 = 75 + a \Rightarrow a = 350 - 75 = \boxed{275 \text{ g}}$$

$$c = \frac{150 \cdot 100}{75} = \boxed{200 \text{ g}}$$

$$b = \frac{200 \cdot 100}{75} = \boxed{267 \text{ g}}$$

$$b + c = 100 + d \Rightarrow d = b + c - 100 =$$

$$= 267 + 200 - 100 = \boxed{367 \text{ g}}$$

$$(8) \quad c = \frac{20 \cdot x}{x} = \boxed{20 \text{ L}} ; g = \frac{50 \cdot x}{x} = \boxed{50 \text{ L}}$$

Las demás incógnitas no pueden saberse por la ley de los volúmenes de combinación, pues sólo pueden relacionarse entre sí los volúmenes de sustancias gaseosas.

$$(9) \quad m_A + m_B + m_C = m_D \Rightarrow$$

$$\Rightarrow 24 + 31 + 67 = a \Rightarrow \boxed{a = 122 \text{ g}}$$

$$c = \frac{31 \cdot 84}{67} = \boxed{38'9 \text{ g}} ; b = \frac{24 \cdot 84}{67} = \boxed{30'1 \text{ g}}$$

$$d = \frac{84 \cdot a}{67} = \frac{84 \cdot 122}{67} = \boxed{153 \text{ g}}$$

$$(10) \quad M_{\text{KClO}_3} = 122.6 \quad ; \quad M_{\text{H}_2\text{O}} = 18$$

$$n = \frac{m}{M} = \frac{150}{122.6} = 1.22 \text{ mol KClO}_3$$

$$a) \quad m_{\text{H}_2\text{O}} = 1.22 \text{ mol KClO}_3 \cdot \frac{3 \text{ mol H}_2\text{O}}{1 \text{ mol KClO}_3} \cdot \frac{18 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{65.9 \text{ g H}_2\text{O}}$$

$$b) \quad N_{\text{KOH}} = 1.22 \text{ mol KClO}_3 \cdot \frac{6 \text{ mol KOH}}{1 \text{ mol KClO}_3} \cdot \frac{6.022 \cdot 10^{23} \text{ moléculas KOH}}{1 \text{ mol KOH}} =$$

$$= \boxed{4.41 \cdot 10^{24} \text{ moléculas KOH}}$$

$$c) \quad n_{\text{KI}} = 1.22 \text{ mol KClO}_3 \cdot \frac{6 \text{ mol KI}}{1 \text{ mol KClO}_3} = \boxed{7.32 \text{ mol KI}}$$

d)

$$V_{\text{I}_2} = 1.22 \text{ mol KClO}_3 \cdot \frac{3 \text{ mol I}_2}{1 \text{ mol KClO}_3} \cdot \frac{22.4 \text{ L I}_2}{1 \text{ mol I}_2} =$$

$$= \boxed{82 \text{ L I}_2}$$

$$(11) \quad M_{\text{HNO}_3} = 63 ; \quad M_{\text{Cu(NO}_3)_2} = 177.8$$

$$n = \frac{m}{M} = \frac{83}{63} = 1.32 \text{ mol HNO}_3$$

$$a) \quad N_{\text{Cu}} = 1.32 \text{ mol HNO}_3 \cdot \frac{3 \text{ mol Cu}}{8 \text{ mol HNO}_3} \cdot \frac{6.022 \cdot 10^{23} \text{ atoms Cu}}{1 \text{ mol Cu}} =$$

$$= \boxed{2.98 \cdot 10^{23} \text{ atoms Cu}}$$

$$b) \quad m_{\text{Cu(NO}_3)_2} = 1.32 \text{ mol HNO}_3 \cdot \frac{3 \text{ mol Cu(NO}_3)_2}{8 \text{ mol HNO}_3} \cdot \frac{177.8 \text{ g Cu(NO}_3)_2}{1 \text{ mol Cu(NO}_3)_2} =$$

$$= \boxed{88 \text{ g Cu(NO}_3)_2}$$

$$c) \quad n_{\text{H}_2\text{O}} = 1.32 \text{ mol HNO}_3 \cdot \frac{4 \text{ mol H}_2\text{O}}{8 \text{ mol HNO}_3} = \boxed{0.66 \text{ mol H}_2\text{O}}$$

$$d) \quad n_{\text{NO}} = 1.32 \text{ mol HNO}_3 \cdot \frac{2 \text{ mol NO}}{8 \text{ mol HNO}_3} = 0.33 \text{ mol NO}$$

$$T_K = T_C + 273 = 20 + 273 = 293 \text{ K}$$

$$P = \frac{570}{760} = 0.75 \text{ atm}$$

$$V_{\text{NO}} = \frac{n \cdot R \cdot T}{P} = \frac{0.33 \cdot 0.082 \cdot 293}{0.75} = \boxed{10.6 \text{ L NO}}$$

$$(12) \quad M_{\text{KMnO}_4} = 158 ;$$

$$M_{\text{MnCl}_2} = 125.8$$

$$n = \frac{m}{M} = \frac{500}{158} = 3.16 \text{ mol KMnO}_4$$

$$a) \quad m_{\text{MnCl}_2} = 3.16 \text{ mol KMnO}_4 \cdot \frac{2 \text{ mol MnCl}_2}{2 \text{ mol KMnO}_4} \cdot \frac{125.8 \text{ g MnCl}_2}{1 \text{ mol MnCl}_2} = \boxed{398 \text{ g MnCl}_2}$$

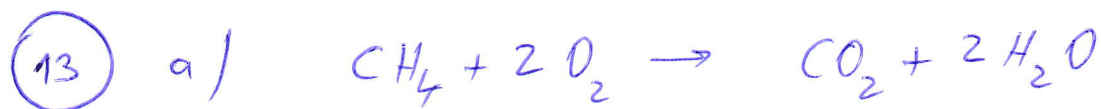
$$b) \quad N_{\text{H}_2\text{O}_2} = 3.16 \text{ mol KMnO}_4 \cdot \frac{5 \text{ mol H}_2\text{O}_2}{2 \text{ mol KMnO}_4} \cdot \frac{6.022 \cdot 10^{23} \text{ moléculas H}_2\text{O}_2}{1 \text{ mol H}_2\text{O}_2} =$$

$$= \boxed{4.76 \cdot 10^{24} \text{ moléculas H}_2\text{O}_2}$$

$$c) \quad n_{\text{KCl}} = 3.16 \text{ mol KMnO}_4 \cdot \frac{2 \text{ mol KCl}}{2 \text{ mol KMnO}_4} = \boxed{3.16 \text{ mol KCl}}$$

$$d) \quad n_{\text{O}_2} = 3.16 \text{ mol KMnO}_4 \cdot \frac{5 \text{ mol O}_2}{2 \text{ mol KMnO}_4} = 7.9 \text{ mol O}_2$$

$$V_{\text{O}_2} = \frac{n \cdot R \cdot T}{P} = \frac{7.9 \cdot 0.082 \cdot (273 + 60)}{2.7} = \boxed{79.9 \text{ L O}_2}$$



b) $V_{\text{O}_2} = 200 \text{ L } \cancel{\text{CH}_4} \cdot \frac{2 \text{ L } \text{O}_2}{1 \text{ L } \cancel{\text{CH}_4}} = \boxed{400 \text{ L } \text{O}_2}$

c) $V_{\text{aire}} = 400 \text{ L } \cancel{\text{O}_2} \cdot \frac{100 \text{ L } \text{aire}}{21 \text{ L } \cancel{\text{O}_2}} = \boxed{1900 \text{ L } \text{aire}}$

d) $V_{\text{H}_2\text{O}} = 200 \text{ L } \cancel{\text{CH}_4} \cdot \frac{2 \text{ L } \text{H}_2\text{O}}{1 \text{ L } \cancel{\text{CH}_4}} = \boxed{400 \text{ L } \text{H}_2\text{O}}$

e) $V_{\text{H}_2\text{O}} = 200 \text{ L } \cancel{\text{CH}_4} \cdot \frac{1 \text{ mol } \cancel{\text{CH}_4}}{22.4 \text{ L } \cancel{\text{CH}_4}} \cdot \frac{2 \text{ mol } \cancel{\text{H}_2\text{O}}}{1 \text{ mol } \cancel{\text{CH}_4}}$

$\cdot \frac{18 \text{ g } \cancel{\text{H}_2\text{O}}}{1 \text{ mol } \cancel{\text{H}_2\text{O}}} \cdot \frac{1 \text{ cm}^3 \text{H}_2\text{O}}{1 \text{ g } \cancel{\text{H}_2\text{O}}} = \boxed{321 \text{ cm}^3}$



(14)

$M_{\text{KNO}_3} = 101'1$;

$M_{\text{Pb}(\text{NO}_3)_2} = 331'2$

$M_{\text{PbCrO}_4} = 323'2$

a) $n = \frac{m}{M} = \frac{50}{331'2} = 0'151 \text{ mol Pb}(\text{NO}_3)_2$

$m_{\text{KNO}_3} = 0'151 \text{ mol Pb}(\text{NO}_3)_2 \cdot \frac{2 \text{ mol KNO}_3}{1 \text{ mol Pb}(\text{NO}_3)_2} \cdot \frac{101'1 \text{ g KNO}_3}{1 \text{ mol KNO}_3} =$
 $= \boxed{30'5 \text{ g KNO}_3}$

b) * Moles de $\text{Pb}(\text{NO}_3)_2$:

$n = 50 \text{ g producto} \cdot \frac{75 \text{ g Pb}(\text{NO}_3)_2}{100 \text{ g producto}} \cdot \frac{1 \text{ mol Pb}(\text{NO}_3)_2}{331'2 \text{ g Pb}(\text{NO}_3)_2} =$
 $= 0'113 \text{ mol Pb}(\text{NO}_3)_2$

* Masa de PbCrO_4 :

$m_{\text{PbCrO}_4} = 0'113 \text{ mol Pb}(\text{NO}_3)_2 \cdot \frac{1 \text{ mol PbCrO}_4}{1 \text{ mol Pb}(\text{NO}_3)_2} \cdot \frac{323'2 \text{ g PbCrO}_4}{1 \text{ mol PbCrO}_4} =$
 $= \boxed{36'6 \text{ g PbCrO}_4}$

c) * Masa de $\text{Pb}(\text{NO}_3)_2$ puro:

$m_{\text{Pb}(\text{NO}_3)_2} = 40 \text{ g PbCrO}_4 \cdot \frac{1 \text{ mol PbCrO}_4}{323'2 \text{ g PbCrO}_4} \cdot \frac{1 \text{ mol Pb}(\text{NO}_3)_2}{1 \text{ mol PbCrO}_4} \cdot \frac{331'2 \text{ g}}{1 \text{ mol}} = 41 \text{ g}$

* Masa de producto impuro:

$m = 41 \text{ g Pb}(\text{NO}_3)_2 \cdot \frac{100 \text{ g puro}}{75 \text{ g Pb}(\text{NO}_3)_2} = \boxed{54'7 \text{ g puro}}$
 (11)