RELAZIONI PONDERALI

1. $FeSO_4 \cdot 7H_2O + K_2Cr_2O_7 + H_2SO_4 \longrightarrow Fe_3(SO_4)_2 + Cr_2(SO_4)_3$

$Fe^{2+} + Cr_2O_7^{2-} + H^+ \longrightarrow Fe^{3+} + Cr^{3+}$

ox. $\quad Fe^{2+} \longrightarrow Fe^{3+} + e^- \qquad /\cdot 6$

red. $\quad \overset{+6}{Cr_2}O_7^{2-} + 6e^- + 14H^+ \longrightarrow 2Cr^{3+} + 7H_2O$

$6Fe^{2+} + Cr_2O_7^{2-} + 14H^+ \longrightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

$$m_{K_2Cr_2O_7} = \frac{2.00}{294.18} = 6.80 \cdot 10^{-3} \text{ mol}$$

$$m_{FeSO_4 \cdot 7H_2O} = 6 \cdot m_{K_2Cr_2O_7} = 6 \cdot 6.80 \cdot 10^{-3} = 4.08 \cdot 10^{-2} \text{ mol}$$

$$m_{FeSO_4 \cdot 7H_2O} = m_{FeSO_4 \cdot 7H_2O} \cdot MM_{FeSO_4 \cdot 7H_2O}$$

$$= 4.08 \cdot 10^{-2} \cdot 278,03 = \boxed{11,3 \text{ g}}$$

2

$$P_4S_{10} + 16\,H_2O \longrightarrow 4\,H_3PO_4 + 10\,H_2S$$

$$n_{P_4S_{10}} = \frac{m_{P_4S_{10}}}{MM_{P_4S_{10}}} = \frac{100.0}{444{,}676} = 0{,}2249\ \text{mol}$$

$$n_{H_3PO_4} = 4 \cdot n_{P_4S_{10}} = 4 \cdot 0{,}2249 = 0{,}8996\ \text{mol}$$

$$m_{H_3PO_4} = n_{H_3PO_4} \cdot MM_{H_3PO_4} = 0{,}8996 \cdot 97{,}995 = \boxed{87{,}18\,g}$$

$$n_{H_2S} = 10 \cdot n_{P_4S_{10}} = 10 \cdot 0{,}2249 = 2{,}249\ \text{mol}$$

$$m_{H_2S} = n_{H_2S} \cdot MM_{H_2S} = 2{,}249 \cdot 34{,}092 = \boxed{76{,}67\,g}$$

3 $x\,Fe + y\,S \longrightarrow Fe_x S_y$

1,00g   0,861g
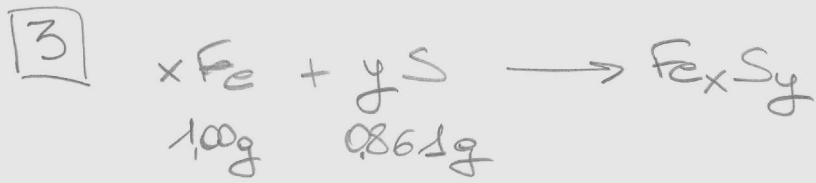
$$n_{Fe} = \frac{m_{Fe}}{MA_{Fe}} = \frac{1,00}{55,845} = 1,79 \cdot 10^{-2}\,mol$$

$$m_S = \frac{m_S}{MA_S} = \frac{0.861}{32,076} = 2,68 \cdot 10^{-2}\,mol$$
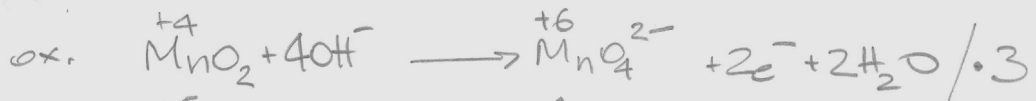
$$x : y = m_{Fe} : m_S$$

$$\frac{y}{x} = \frac{m_S}{m_{Fe}} = \frac{2.68 \cdot 10^{-2}}{1.79 \cdot 10^{-2}} = 1,50 = \frac{3}{2}$$

$$\boxed{Fe_2 S_3}$$

REAGENTE LIMITANTE

$\boxed{1}$ $MnO_2 + KClO_3 + KOH \longrightarrow K_2MnO_4 + KCl$

$\overset{+4}{Mn}O_2 + \overset{+5}{Cl}O_3^- + OH^- \longrightarrow \overset{+6}{Mn}O_4^{2-} + \overset{-1}{Cl}^-$

ox. $\quad \overset{+4}{Mn}O_2 + 4OH^- \longrightarrow \overset{+6}{Mn}O_4^{2-} + 2e^- + 2H_2O \; / \cdot 3$

red. $\quad \overset{+5}{Cl}O_3^- + 6e^- + 3H_2O \longrightarrow \overset{-1}{Cl}^- + 6OH^-$

$$3MnO_2 + \overset{6}{\cancel{12}OH^-} + ClO_3^- + \cancel{3H_2O} \longrightarrow 3MnO_4^{2-} + \overset{3}{\cancel{6}H_2O} + Cl^- + \cancel{6OH^-}$$

$3MnO_2 + KClO_3 + 6KOH \longrightarrow 3K_2MnO_4 + KCl + 3H_2O$

6,00g $\quad$ 15,0g
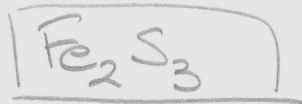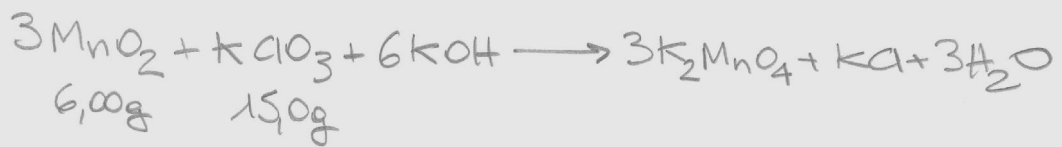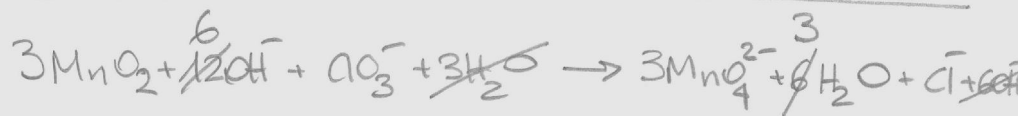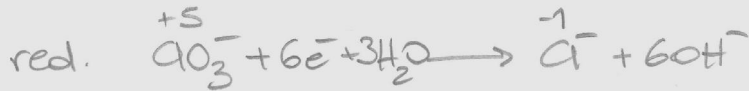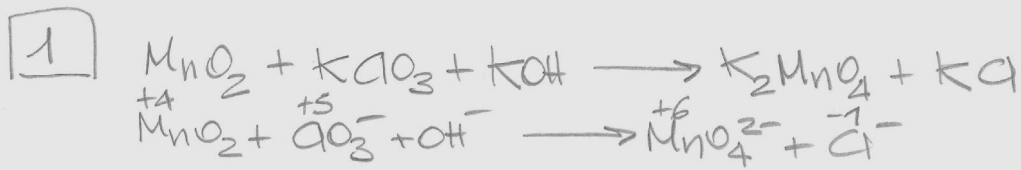
$m_{MnO_2} = \dfrac{m_{MnO_2}}{MM_{MnO_2}} = \dfrac{6,00}{86,937} = 6,90 \cdot 10^{-2} \, mol$

$m_{KClO_3} = \dfrac{m_{KClO_3}}{MM_{KClO_3}} = \dfrac{15,0}{122,55} = 0,122 \, mol$

$\quad\quad\quad 3MnO_2 + KClO_3 + 6KOH \longrightarrow 3K_2MnO_4 + KCl + 3H_2O$

inizio	$6,90 \cdot 10^{-2}$	$0,122$	ecc.			
variazione	$-6,90 \cdot 10^{-2}$	$-2,30 \cdot 10^{-2}$		$+6,90 \cdot 10^{-2}$	$+2,30 \cdot 10^{-2}$	
fine	—	$0,099$		$6,90 \cdot 10^{-2}$	$2,30 \cdot 10^{-2}$	

↑
REAGENTE
LIMITANTE

$m_{K_2MnO_4} = m_{K_2MnO_4} \cdot MM_{K_2MnO_4} = 6,90 \cdot 10^{-2} \cdot 181,132 =$

$= \boxed{1,25 \, g}$

2

$$CaCO_3 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + H_2O_{(l)} + CO_{2(g)}$$

	$4.78 \cdot 10^{-2}$	0,117			
inizio					
variazione	$-4.78 \cdot 10^{-2}$	0,0956	$+4.78 \cdot 10^{-2}$	$+4.78 \cdot 10^{-2}$	$+4.78 \cdot 10^{-2}$
fine	—	$2,14 \cdot 10^{-2}$	$4.78 \cdot 10^{-2}$	$4.78 \cdot 10^{-2}$	$4.78 \cdot 10^{-2}$

↑
REAG. LIM.

$$n_{CaCO_3} = \frac{m_{CaCO_3}}{MM_{CaCO_3}} = \frac{4.78}{100,087} = 4,78 \cdot 10^{-2} \ mol$$

$$n_{HNO_3} = \frac{m_{HNO_3}}{MM_{HNO_3}} = \frac{7,38}{63,01} = 0,117 \ mol$$

$$V_{CO_2} = \frac{n_{CO_2} \cdot RT}{P} = \frac{4.78 \cdot 10^{-2} \cdot 0,0821 \cdot 298,15}{1,00} = \boxed{1,17 \ L}$$

RESA DELLE REAZIONI CHIMICHE

1

$$CH_3COOH + CH_3CH_2OH \longrightarrow CH_3COOCH_2CH_3 + H_2O$$

	CH_3COOH	CH_3CH_2OH	$CH_3COOCH_2CH_3$	H_2O
inizio	0.414	0.429		
variazione	−0.414	−0.414	+0.414	+0.414
fine	——	0,015	0,414	0.414

$$n_{CH_3COOH} = \frac{m_{CH_3COOH}}{MM_{CH_3COOH}} = \frac{25,0}{60.328} = 0.414 \, mol$$

$$n_{CH_3CH_2OH} = \frac{m_{CH_3CH_2OH}}{MM_{CH_3CH_2OH}} = \frac{20.0}{46,600} = 0,429 \, mol$$

$$m_{CH_3COOCH_2CH_3} = n_{CH_3COOCH_2CH_3} \cdot MM_{CH_3COOCH_2CH_3} = 0.414 \cdot 88,106 =$$
$$= 35,6 \, g \, \text{TEORICI}$$

$$Y = \frac{m_{ottenuta}}{m_{teorica}} = \frac{29,5}{35,6} \cdot 100 = \boxed{82,8 \%}$$

2 $(C_6H_5)_3As + H_2O_2 \longrightarrow (C_6H_5)_3AsO + H_2O$
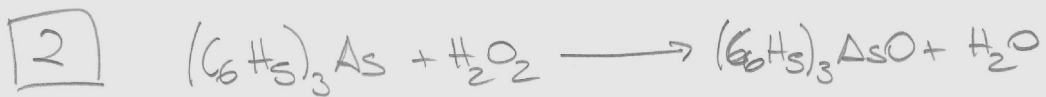
$$m_{(C_6H_5)_3As} = \frac{m_{(C_6H_5)_3As}}{MM_{(C_6H_5)_3As}} = \frac{100,0}{306,239} = 0,3265 \text{ mol}$$

$$\downarrow = m_{(C_6H_5)_3AsO}$$

$$m_{(C_6H_5)_3AsO} = m_{(C_6H_5)_3AsO} \cdot MM_{(C_6H_5)_3AsO} = 0.3265 \cdot 322,238$$

$$= 105,2g$$
$$\text{TEORICI}$$

$$m_{(C_6H_5)_3AsO \text{ effettiva}} = m_{(C_6H_5)_3AsO} \cdot Y = 105,2 \cdot \frac{85,0}{100} =$$

$$= \boxed{89,4 \text{ g}}$$