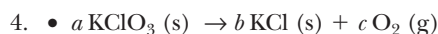
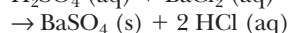
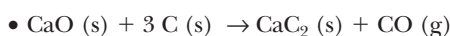
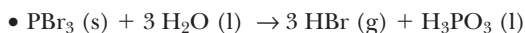
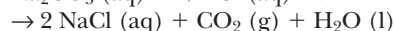
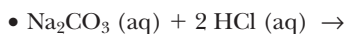
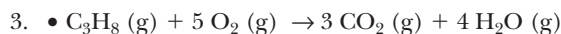


Kloro gaseosoak hainbat aplikazio ditu industrian. Besteren artean, polivinilo kloruroaren (PVC) ekoizpena aipa dezakegu, eta baita bestelako plastiko, koloratzaile eta produktu organikorena ere.

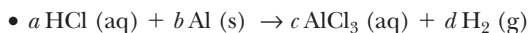
Papergintzan eta ehungintzan ere erabiltzen da, produktu zuriztatzaile modura; bestalde, uren desinfektiazioarako ere oso erabilia da.

EKUAZIO KIMIKOAK



$$3 \cdot 1 = 2c ; c = \frac{3}{2}$$

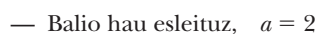
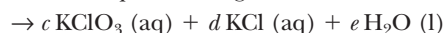
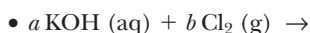
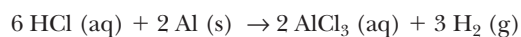
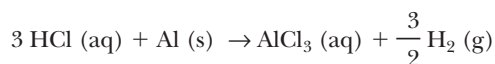
— eta azkenik, emaitza hau dugu:



$$a = 3$$

$$d = \frac{3}{2}$$

— eta azkenik, emaitza hau dugu:



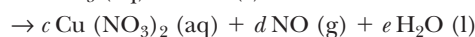
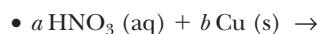
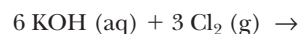
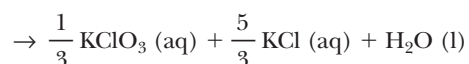
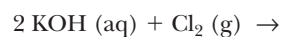
— hauxe lortuko dugu: $e = 1$

$$a = 3c + e ; c = \frac{1}{3}$$

$$a = c + d ; d = \frac{5}{3}$$

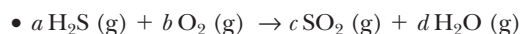
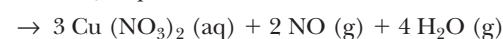
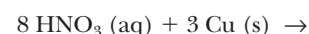
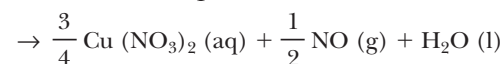
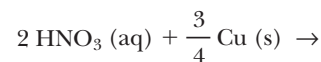
$$2b = c + d ; b = 1$$

— eta azkenik, emaitza hau dugu:



$$\begin{cases} a = 2c + d & c = \frac{3}{4} \\ 3a = 6c + d + e & d = \frac{1}{2} \\ b = c & b = \frac{3}{4} \end{cases} \Rightarrow$$

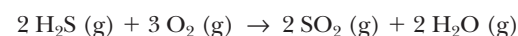
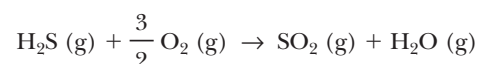
— eta azkenik, emaitza hau dugu:



$$c = 1$$

$$2b = 2c + d ; b = \frac{3}{2}$$

— eta azkenik, emaitza hau dugu:



5. $\text{Pb (s)} + \text{HNO}_3 \text{ (aq)} \rightarrow$
 $\rightarrow \text{Pb(NO}_3)_2 \text{ (aq)} + \text{NO}_2 \text{ (g)} + \text{H}_2\text{O (l)}$
- • Erreaktiboak: Pb solidoa
 HNO_3 ur-disoluzioa
 - Produktuak: $\text{Pb(NO}_3)_2$ ur-disoluzioa
 NO_2 gasa
 H_2O likidoa
- $a \text{ Pb (s)} + b \text{ HNO}_3 \text{ (aq)} \rightarrow$
 $\rightarrow c \text{ Pb(NO}_3)_2 \text{ (aq)} + d \text{ NO}_2 \text{ (g)} + e \text{ H}_2\text{O (l)}$
- Pb-ari dagokionez: $a = c$
H-ari dagokionez: $b = 2e$
N-ari dagokionez: $b = 2c + d$
O-ari dagokionez: $3b = 6c + 2d + e$
- Balio hau esleituz, $b = 2$
— hauxe lortuko dugu: $e = 1$

$$\begin{cases} b = 2c + d & \Rightarrow c = \frac{1}{2} \\ 3b = 6c + 2d + e & d = 1 \\ a = \frac{1}{2} \end{cases}$$

2 zenbakiaz biderkatuz:

- $\text{Pb (s)} + 4 \text{ HNO}_3 \text{ (aq)} \rightarrow$
 $\rightarrow \text{Pb(NO}_3)_2 \text{ (aq)} + 2 \text{ NO}_2 \text{ (g)} + 2 \text{ H}_2\text{O (l)}$
- 4 mol HNO_3 -rekin erreakzionatzen duen mol Pb bakoitzeko, honako hau lortzen da: 1 mol $\text{Pb(NO}_3)_2$, 2 mol NO_2 eta 2 mol ur, H_2O .
- $M(\text{Pb}) = 207,2 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{HNO}_3) = 63 \text{ g} \cdot \text{mol}^{-1}$
 $M[\text{Pb(NO}_3)_2] = 331,2 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{NO}_2) = 46 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{H}_2\text{O}) = 18 \text{ g} \cdot \text{mol}^{-1}$
- 207,2 g Pb-k $4 \cdot 63 \text{ g HNO}_3$ -rekin erreakzionatzen dute, eta lortzen dira: 331,2 g $\text{Pb(NO}_3)_2$, $2 \cdot 46 \text{ g NO}_2$ eta $2 \cdot 18 \text{ g ur}$.
- Konposatu gaseosoa: NO_2
Mol batek 22,4 L-eko bolumena du egoera normalean.
 $2 \cdot 22,4 \text{ L NO}_2$ lortuko dira erreakzioan.

KALKULU ESTEKIOMETRIKOAK

9. $2 \text{ Al (s)} + 3 \text{ I}_2 \text{ (s)} \rightarrow 2 \text{ AlI}_3 \text{ (s)}$
- $M(\text{I}_2) = 253,8 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{AlI}_3) = 407,7 \text{ g} \cdot \text{mol}^{-1}$
- $$25 \text{ g I}_2 \cdot \frac{1 \text{ mol I}_2}{253,8 \text{ g I}_2} \cdot \frac{2 \text{ mol AlI}_3}{3 \text{ mol I}_2} \cdot \frac{407,7 \text{ g AlI}_3}{1 \text{ mol AlI}_3} = 26,8 \text{ g AlI}_3$$
- 25 g I_2 -rekin, 26 g AlI_3 lortuko dira.

6. • Erreaktiboak: CO gasa
 Fe_2O_3 solidoa
- Produktuak: FeO solidoa
 CO_2 gasa
- $\text{Fe}_2\text{O}_3 \text{ (s)} + \text{CO (g)} \rightarrow 2 \text{ FeO (s)} + \text{CO}_2 \text{ (g)}$
- Fe_2O_3 «molekula» batek CO molekula batekin erreakzionatu du, eta 2 FeO- «molekula» eta CO_2 molekula bat lortu dira.
- $M(\text{Fe}_2\text{O}_3) = 159,6 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{CO}) = 28 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{FeO}) = 71,8 \text{ g} \cdot \text{mol}^{-1}$
 $M(\text{CO}_2) = 44 \text{ g} \cdot \text{mol}^{-1}$
- Masen bidez adierazita:
159,6 g Fe_2O_3 -k 22,4 L CO-rekin erreakzionatzen dute, eta lortzen dira: $2 \cdot 71,8 \text{ g FeO}$ eta 22,4 L CO_2 .

ERREAKZIO KIMIKO MOTAK

7. $\text{NH}_3 \text{ (g)} + \text{HCl (g)} \rightarrow \text{NH}_4\text{Cl (g)}$
sintesi-erreakzioa
- $2 \text{ NH}_3 \text{ (g)} + 3 \text{ Mg (s)} \rightarrow \text{N}_2\text{Mg}_3 \text{ (s)} + 3 \text{ H}_2 \text{ (g)}$
desplazamendu-erreakzioa
- $\text{Zn (s)} + \text{H}_2\text{SO}_4 \text{ (aq)} \rightarrow \text{ZnSO}_4 \text{ (aq)} + \text{H}_2 \text{ (g)}$
desplazamendu-erreakzioa
- $\text{PCl}_5 \text{ (s)} \rightarrow \text{PCl}_3 \text{ (s)} + \text{Cl}_2 \text{ (g)}$
deskonposizio-erreakzioa
- $2 \text{ H}_2\text{S (aq)} + \text{O}_2 \text{ (g)} \rightarrow 2 \text{ S (s)} + 2 \text{ H}_2\text{O (l)}$
desplazamendu-erreakzioa
- $3 \text{ HCl (aq)} + \text{Al(OH)}_3 \text{ (s)} \rightarrow \text{AlCl}_3 \text{ (aq)} + 3 \text{ H}_2\text{O (l)}$
desplazamendu bikoitzeko erreakzioa
8. $3 \text{ NH}_4\text{OH (aq)} + \text{AlCl}_3 \text{ (aq)} \rightarrow$
 $\rightarrow \text{Al(OH)}_3 \text{ (s)} + 3 \text{ NH}_4\text{Cl (aq)}$
desplazamendu bikoitzeko erreakzioa

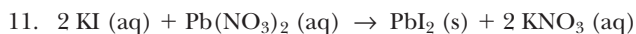


$$M (\text{HCl}) = 36,5 \text{ g} \cdot \text{mol}^{-1}$$

$$M (\text{MnCl}_2) = 126 \text{ g} \cdot \text{mol}^{-1}$$

$$20 \text{ g HCl} \cdot \frac{1 \text{ mol HCl}}{36,5 \text{ g HCl}} \cdot \frac{1 \text{ mol MnCl}_2}{4 \text{ mol HCl}} \cdot \frac{126 \text{ g MnCl}_2}{1 \text{ mol MnCl}_2} = 17,3 \text{ g MnCl}_2$$

20 g HCl-rekin 17,3 g MnCl₂ lortuko dira.

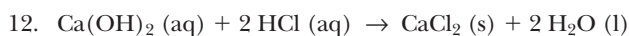


$$M (\text{KI}) = 166 \text{ g} \cdot \text{mol}^{-1}$$

$$M (\text{PbI}_2) = 461 \text{ g} \cdot \text{mol}^{-1}$$

$$15 \text{ g KI} \cdot \frac{1 \text{ mol KI}}{166 \text{ g KI}} \cdot \frac{1 \text{ mol PbI}_2}{2 \text{ mol KI}} \cdot \frac{461 \text{ g PbI}_2}{1 \text{ mol PbI}_2} = 20,8 \text{ g PbI}_2$$

15 g KI-rekin 20,8 g PbI₂ lortuko dira.

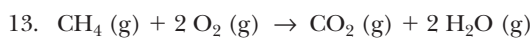


$$M (\text{HCl}) = 36,5 \text{ g} \cdot \text{mol}^{-1}$$

$$M [\text{Ca}(\text{OH})_2] = 74 \text{ g} \cdot \text{mol}^{-1}$$

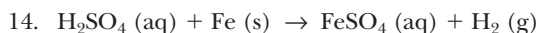
$$16,5 \text{ g HCl} \cdot \frac{1 \text{ mol HCl}}{36,5 \text{ g HCl}} \cdot \frac{1 \text{ mol Ca}(\text{OH})_2}{2 \text{ mol HCl}} \cdot \frac{74 \text{ g Ca}(\text{OH})_2}{1 \text{ mol Ca}(\text{OH})_2} = 16,7 \text{ g Ca}(\text{OH})_2$$

16,7 g Ca(OH)₂ behar dira 16,5 g HCl-rekin erreakzionatzeko.



$$56 \text{ L CH}_4 \cdot \frac{1 \text{ mol CH}_4}{22,4 \text{ L CH}_4} \cdot \frac{2 \text{ mol O}_2}{1 \text{ mol CH}_4} \cdot \frac{22,4 \text{ L O}_2}{1 \text{ mol O}_2} = 112 \text{ L O}_2$$

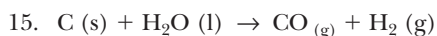
112 L O₂ behar dira 56 L metano erabat erre daitezzen.



$$M (\text{Fe}) = 55,8 \text{ g} \cdot \text{mol}^{-1}$$

$$15 \text{ g Fe} \cdot \frac{1 \text{ mol Fe}}{55,8 \text{ g Fe}} \cdot \frac{1 \text{ mol H}_2}{1 \text{ mol Fe}} \cdot \frac{22,4 \text{ L H}_2}{1 \text{ mol H}_2} = 6 \text{ L H}_2$$

15 g Fe-K erreakzionatuz gero, 6 L hidrogeno lortuko dira, ENean neurtuta.

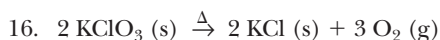


$$M (\text{C}) = 12 \text{ g} \cdot \text{mol}^{-1}$$

$$100 \text{ L H}_2 \cdot \frac{1 \text{ mol H}_2}{22,4 \text{ L H}_2} \cdot \frac{1 \text{ mol C}}{1 \text{ mol H}_2} \cdot \frac{12 \text{ g C}}{1 \text{ mol C}} = 53,6 \text{ g C}$$

$$100 \text{ L H}_2 \cdot \frac{1 \text{ mol H}_2}{22,4 \text{ L H}_2} \cdot \frac{1 \text{ mol CO}}{1 \text{ mol H}_2} \cdot \frac{22,4 \text{ L CO}}{1 \text{ mol CO}} = 100 \text{ L CO}$$

100 L H₂ lortzeko, 53,6 g karbono behar dira, eta erreakzio horretan 100 L karbono monoxido eratuko dira, egoera normalean neurtuak.



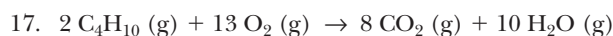
$$M (\text{KClO}_3) = 122,6 \text{ g} \cdot \text{mol}^{-1}$$

$$M (\text{KCl}) = 74,6 \text{ g} \cdot \text{mol}^{-1}$$

$$23 \text{ g } \cancel{\text{KClO}_3} \frac{1 \text{ mol } \cancel{\text{KClO}_3}}{122,6 \text{ g } \cancel{\text{KClO}_3}} \cdot \frac{2 \text{ mol } \cancel{\text{KCl}}}{2 \text{ mol } \cancel{\text{KClO}_3}} \cdot \frac{74,6 \text{ g } \text{KCl}}{1 \text{ mol } \cancel{\text{KCl}}} = 14 \text{ g } \text{KCl}$$

$$23 \text{ g } \cancel{\text{KClO}_3} \frac{1 \text{ mol } \cancel{\text{KClO}_3}}{122,6 \text{ g } \cancel{\text{KClO}_3}} \cdot \frac{3 \text{ mol } \text{O}_2}{2 \text{ mol } \cancel{\text{KClO}_3}} \cdot \frac{22,4 \text{ L } \text{O}_2}{1 \text{ mol } \text{O}_2} = 6,3 \text{ L } \text{O}_2$$

23 g potasio kloratoz, 14 g potasio kloruro eta 6,3 L O₂ oxigeno lortuko dira, ENean.



$$T (\text{CO}_2) = 75 \text{ }^\circ\text{C} + 273 = 348 \text{ K}$$

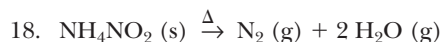
$$P (\text{CO}_2) = 750 \text{ mm Hg} \frac{1 \text{ atm}}{760 \text{ mm Hg}} = 0,987 \text{ atm}$$

$$n (\text{CO}_2) = \frac{PV}{RT} = \frac{0,987 \text{ atm} \cdot 145 \text{ L}}{0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 348 \text{ K}} = 5,015 \text{ mol } \text{CO}_2$$

$$M (\text{C}_4\text{H}_{10}) = 58 \text{ g} \cdot \text{mol}^{-1}$$

$$5,015 \text{ mol } \cancel{\text{CO}_2} \frac{2 \text{ mol } \cancel{\text{C}_4\text{H}_{10}}}{8 \text{ mol } \cancel{\text{CO}_2}} \cdot \frac{58 \text{ g } \text{C}_4\text{H}_{10}}{1 \text{ mol } \cancel{\text{C}_4\text{H}_{10}}} = 72,7 \text{ g } \text{C}_4\text{H}_{10}$$

72,7 g butano erre behar dira.

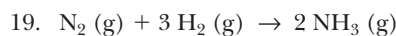


$$M (\text{NH}_4\text{NO}_2) = 64 \text{ g}$$

$$n (\text{N}_2) = 25 \text{ g } \cancel{\text{NH}_4\text{NO}_2} \frac{1 \text{ mol } \cancel{\text{NH}_4\text{NO}_2}}{64 \text{ g } \cancel{\text{NH}_4\text{NO}_2}} \cdot \frac{1 \text{ mol } \text{N}_2}{1 \text{ mol } \cancel{\text{NH}_4\text{NO}_2}} = 0,391 \text{ mol } \text{N}_2$$

$$V (\text{N}_2) = \frac{nRT}{P} = \frac{0,391 \text{ mol} \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot (30 + 273) \text{ K}}{2 \text{ atm}} = 4,9 \text{ L } \text{N}_2$$

4,9 L nitrogeno lortuko dira, egoera normalean neurtuta.



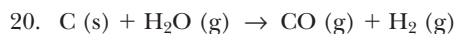
$$M (\text{NH}_3) = 17 \text{ g}$$

$$n (\text{H}_2) = 30 \text{ g } \cancel{\text{NH}_3} \frac{1 \text{ mol } \cancel{\text{NH}_3}}{17 \text{ g } \cancel{\text{NH}_3}} \cdot \frac{3 \text{ mol } \text{H}_2}{2 \text{ mol } \cancel{\text{NH}_3}} = 2,647 \text{ mol } \text{H}_2$$

$$P = 725 \text{ mm Hg} \frac{1 \text{ atm}}{760 \text{ mm Hg}} = 0,954 \text{ atm}$$

$$V (\text{H}_2) = \frac{nRT}{P} = \frac{2,647 \text{ mol} \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 298 \text{ K}}{0,954 \text{ atm}} = 67,8 \text{ L } \text{H}_2$$

67,8 L H₂ konbinatu behar dira.



$$T (\text{CO}) = 500 \text{ }^\circ\text{C} + 273 = 773 \text{ K}$$

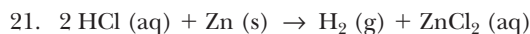
$$P (\text{CO}) = 850 \text{ mm Hg} \frac{1 \text{ atm}}{760 \text{ mm Hg}} = 1,118 \text{ atm}$$

$$M (\text{C}) = 12 \text{ g} \cdot \text{mol}^{-1}$$

$$n (\text{CO}) = 250 \text{ g } \cancel{\text{C}} \frac{1 \text{ mol } \cancel{\text{C}}}{12 \text{ g } \cancel{\text{C}}} \cdot \frac{1 \text{ mol } \text{CO}}{1 \text{ mol } \cancel{\text{C}}} = 20,83 \text{ mol } \text{CO}$$

$$V (\text{CO}) = \frac{nRT}{P} = \frac{20,83 \text{ mol} \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 773 \text{ K}}{1,118 \text{ atm}} = 1181 \text{ L } \text{CO}$$

1181 L karbono monoxido lortuko dira.



$$M(\text{Zn}) = 65,4 \text{ g} \cdot \text{mol}^{-1}$$

$$M(\text{HCl}) = 36,5 \text{ g} \cdot \text{mol}^{-1}$$

$$40 \text{ g Zn} \cdot \frac{1 \text{ mol Zn}}{65,4 \text{ g Zn}} \cdot \frac{2 \text{ mol HCl}}{1 \text{ mol Zn}} \cdot \frac{36,5 \text{ g HCl}}{1 \text{ mol HCl}} = 44,6 \text{ g HCl}$$

44,6 g azido klorhidriko behar dira.

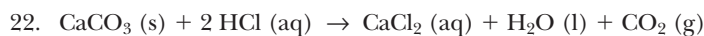
$$T(\text{H}_2) = 20 \text{ }^\circ\text{C} + 273 = 293 \text{ K}$$

$$P(\text{H}_2) = 825 \text{ mm Hg} \cdot \frac{1 \text{ atm}}{760 \text{ mm Hg}} = 1,0855 \text{ atm}$$

$$n(\text{H}_2) = 40 \text{ g Zn} \cdot \frac{1 \text{ mol Zn}}{65,4 \text{ g Zn}} \cdot \frac{1 \text{ mol H}_2}{1 \text{ mol Zn}} = 0,6116 \text{ mol H}_2$$

$$V(\text{H}_2) = \frac{nRT}{P} = \frac{0,6116 \text{ mol} \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 293 \text{ K}}{1,0855 \text{ atm}} = 13,5 \text{ L}$$

13,5 L H_2 askatuko dira.



$$M(\text{CO}_2) = 44 \text{ g} \cdot \text{mol}^{-1}$$

$$M(\text{CaCO}_3) = 100 \text{ g} \cdot \text{mol}^{-1}$$

$$205 \text{ g CaCO}_3 \cdot \frac{1 \text{ mol CaCO}_3}{100 \text{ g CaCO}_3} \cdot \frac{1 \text{ mol CO}_2}{1 \text{ mol CaCO}_3} \cdot \frac{44 \text{ g CO}_2}{1 \text{ mol CO}_2} = 90,2 \text{ g CO}_2$$

90,2 g karbono dioxido askatuko dira.

$$T(\text{CO}_2) = 30 \text{ }^\circ\text{C} + 273 = 303 \text{ K}$$

$$P(\text{CO}_2) = 780 \text{ mm Hg} \cdot \frac{1 \text{ atm}}{760 \text{ mm Hg}} = 1,026 \text{ atm}$$

$$n(\text{CO}_2) = 90,2 \text{ g CO}_2 \cdot \frac{1 \text{ mol CO}_2}{44 \text{ g CO}_2} = 2,05 \text{ mol CO}_2$$

$$V(\text{CO}_2) = \frac{nRT}{P} = \frac{2,05 \text{ mol} \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 303 \text{ K}}{1,026 \text{ atm}} = 49,6 \text{ L}$$

Egoera horretan, 90,2 g CO_2 -k 49,6 L-ko bolumena betetzen dute.



$$M(\text{MnO}_2) = 87 \text{ g} \cdot \text{mol}^{-1}$$

$$80 \text{ g MnO}_2 \cdot \frac{1 \text{ mol MnO}_2}{87 \text{ g MnO}_2} \cdot \frac{1 \text{ mol Cl}_2}{1 \text{ mol MnO}_2} \cdot \frac{22,4 \text{ L Cl}_2}{1 \text{ mol Cl}_2} = 20,6 \text{ L Cl}_2$$

20,6 L kloro (gasa) lortuko dira, egoera normalean neurtuta.

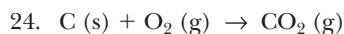
$$M(\text{Cl}_2) = 71 \text{ g} \cdot \text{mol}^{-1}$$

$$n(\text{Cl}_2) = 80 \text{ g MnO}_2 \cdot \frac{1 \text{ mol MnO}_2}{87 \text{ g MnO}_2} \cdot \frac{1 \text{ mol Cl}_2}{1 \text{ mol MnO}_2} = 0,92 \text{ mol Cl}_2$$

$$V(\text{Cl}_2) = \frac{nRT}{P} = \frac{0,92 \text{ mol} \cdot 8,314 \text{ Pa} \cdot \text{m}^3 \cdot \text{mol}^{-1} \cdot \text{K}^{-1} \cdot 425 \text{ K}}{169000 \text{ Pa}} = 1,92 \cdot 10^{-2} \text{ m}^3 \text{ Cl}_2$$

$$1,92 \cdot 10^{-2} \text{ m}^3 \text{ Cl}_2 \cdot \frac{1000 \text{ L Cl}_2}{1 \text{ m}^3 \text{ Cl}_2} = 19,2 \text{ L Cl}_2$$

Bigarren kasuan, 19,2 L kloro (gasa) lortuko dira.



$$T(CO_2) = 25\text{ }^\circ\text{C} + 273 = 298\text{ K}$$

$$P(CO_2) = 700 \frac{\text{mm Hg}}{760 \text{ mm Hg}} = 0,921 \text{ atm}$$

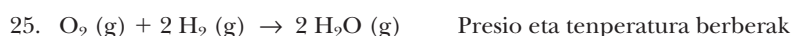
$$V(O_2) = 45 \text{ L} = 45 \cdot 10^{-3} \text{ m}^3$$

$$n(O_2) = \frac{PV}{RT} = \frac{3,04 \cdot 10^5 \text{ Pa} \cdot 45 \cdot 10^{-3} \text{ m}^3}{8,314 \text{ Pa} \cdot \text{m}^3 \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 523 \text{ K}} = 3,146 \text{ mol } O_2$$

$$n(CO_2) = 3,146 \text{ mol } O_2 \frac{1 \text{ mol } CO_2}{1 \text{ mol } O_2} = 3,146 \text{ mol } CO_2$$

$$V(CO_2) = \frac{nRT}{P} = \frac{3,146 \text{ mol } CO_2 \cdot 0,082 \text{ atm} \cdot \text{L} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \cdot 298 \text{ K}}{0,921 \text{ atm}} = 83,5 \text{ L } CO_2$$

83,5 L karbono dioxido lortuko dira.



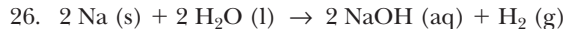
$$V(O_2) = V(H_2)$$

Avogadro-ren legearen arabera, mota desberdineko gasen bolumen berberak, presio eta temperatura berberetan neurtzen badira, molekula kopuru berbera dute, hau da, mol kopuru berbera dute; beraz, mol oxigeno adina mol hidrogeno ditugu: $n(O_2) = n(H_2)$

Erreaktibotako baten mol kopuruan oinarriturik, beste erreaktibotik behar dugun mol kopurua kalkulatu dugu, erreakzio kimiko honi jarraituz:

$$n \text{ mol } O_2 \frac{2 \text{ mol } H_2}{1 \text{ mol } O_2} = 2 \cdot n \text{ mol } H_2$$

n mol H_2 baino ez ditugunez, eta kontuan hartuta $2n$ mol H_2 behar ditugula n mol O_2 -k erreakziona dezaten, ondorioztatzen da erreaktibo mugatzailea H_2 -a dela, eta O_2 -aren kantitatea gehiegizkoa dela.



$$M(Na) = 23 \text{ g} \cdot \text{mol}^{-1}$$

$$M(NaOH) = 40 \text{ g} \cdot \text{mol}^{-1}$$

$$M(H_2O) = 18 \text{ g} \cdot \text{mol}^{-1}$$

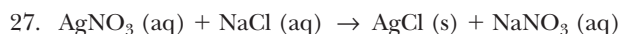
$$n(Na) = 10 \text{ g } Na \frac{1 \text{ mol } Na}{23 \text{ g } Na} = 0,435 \text{ mol } Na \Rightarrow \text{mugatzailea}$$

$$n(H_2O) = 9 \text{ g } H_2O \frac{1 \text{ mol } H_2O}{18 \text{ g } H_2O} = 0,5 \text{ mol } H_2O \Rightarrow \text{gehiagizko kantitatean}$$

Erreakzioa gertatzeko, Na-aren eta H_2O -aren mol kopuru berberak behar dira; beraz, sodioa lehenago kontsumituko da. Gehiegizko erreaktibo ura da, eta erreaktibo mugatzailea, sodio metalikoa.

$$10 \text{ g } Na \frac{1 \text{ mol } Na}{23 \text{ g } Na} \cdot \frac{2 \text{ mol } NaOH}{2 \text{ mol } Na} \cdot \frac{40 \text{ g}}{1 \text{ mol } NaOH} = 17,4 \text{ g } NaOH$$

17,4 g sodio hidroxido eratuko dira.



$$M(AgCl) = 143,4 \text{ g} \cdot \text{mol}^{-1}$$

$$M(AgNO_3) = 169,9 \text{ g} \cdot \text{mol}^{-1}$$

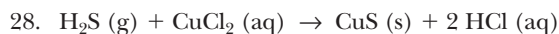
$$14 \text{ g } AgCl \frac{1 \text{ mol } AgCl}{143,4 \text{ g } AgCl} \cdot \frac{1 \text{ mol } AgNO_3}{1 \text{ mol } AgCl} \cdot \frac{169,9 \text{ g } AgNO_3}{1 \text{ mol } AgNO_3} = 16,6 \text{ g } AgNO_3$$

16,6 g zilar nitratok erreakzionatu dute.

Ikus dezagun zein den erreakzionatu gabe geratu den kantitatea:

$$25 \text{ g } AgNO_3 - 16,6 \text{ g } AgNO_3 = 8,4 \text{ g } AgNO_3$$

Erreakzionatu gabe geratu den zilar nitratoaren masa 8,4 g-koa da.



$$M (\text{CuCl}_2) = 134,5 \text{ g} \cdot \text{mol}^{-1}$$

Erreaktibo mugatzailea zein den bilatuko dugu lehenik:

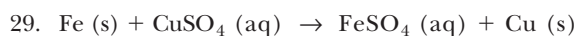
$$n (\text{H}_2\text{S}) = 5 \text{ L } \cancel{\text{H}_2\text{S}} \frac{1 \text{ mol } \text{H}_2\text{S}}{22,4 \text{ L } \cancel{\text{H}_2\text{S}}} = 0,223 \text{ mol } \text{H}_2\text{S}$$

$$n (\text{CuCl}_2) = 25 \text{ g } \cancel{\text{CuCl}_2} \frac{1 \text{ mol } \text{CuCl}_2}{134,5 \text{ g } \cancel{\text{CuCl}_2}} = 0,186 \text{ mol } \text{CuCl}_2 \Rightarrow \text{Erreaktibo mugatzailea}$$

$$M (\text{CuS}) = 95,5 \text{ g} \cdot \text{mol}^{-1}$$

$$25 \text{ g } \cancel{\text{CuCl}_2} \frac{1 \text{ mol } \cancel{\text{CuCl}_2}}{134,5 \text{ g } \cancel{\text{CuCl}_2}} \cdot \frac{1 \text{ mol } \cancel{\text{CuS}}}{1 \text{ mol } \cancel{\text{CuCl}_2}} \cdot \frac{95,5 \text{ g } \text{CuS}}{1 \text{ mol } \cancel{\text{CuS}}} = 17,8 \text{ g } \text{CuS}$$

17,8 g kobre (II) sulfuro eratuko dira.



$$V = 250 \text{ mL}$$

Masaren % 15

$$d = 1,05 \text{ g} \cdot \text{mL}^{-1}$$

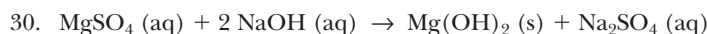
$$M (\text{CuSO}_4) = 159,5 \text{ g} \cdot \text{mol}^{-1}$$

$$M (\text{Fe}) = 55,8 \text{ g} \cdot \text{mol}^{-1}$$

$$250 \text{ mL } \cancel{\text{disoluzio}} \frac{1,05 \text{ g } \cancel{\text{disoluzio}}}{1 \text{ mL } \cancel{\text{disoluzio}}} \cdot \frac{15 \text{ g } \cancel{\text{CuSO}_4}}{100 \text{ g } \cancel{\text{disoluzio}}} \cdot \frac{1 \text{ mol } \cancel{\text{CuSO}_4}}{159,5 \text{ g } \cancel{\text{CuSO}_4}} \cdot \frac{1 \text{ mol } \text{Fe}}{1 \text{ mol } \cancel{\text{CuSO}_4}} \cdot \frac{55,8 \text{ g } \text{Fe}}{1 \text{ mol } \cancel{\text{Fe}}} =$$

$$= 13,8 \text{ g } \text{Fe}$$

13,8 g burdinak erreakzionatuko dute.



$$V = 150 \text{ mL}$$

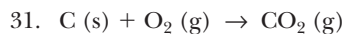
2 M

$$M (\text{Mg}(\text{OH})_2) = 58,3 \text{ g} \cdot \text{mol}^{-1}$$

$$150 \text{ mL } \cancel{\text{disoluzio}} \frac{1 \cancel{\text{L}}}{1000 \text{ mL}} \cdot \frac{2 \text{ mol } \cancel{\text{NaOH}}}{1 \text{ L } \cancel{\text{disoluzio}}} \cdot \frac{1 \text{ mol } \cancel{\text{Mg}(\text{OH})_2}}{2 \text{ mol } \cancel{\text{NaOH}}} \cdot \frac{58,3 \text{ g } \text{Mg}(\text{OH})_2}{1 \text{ mol } \cancel{\text{Mg}(\text{OH})_2}} = 8,7 \text{ g } \text{Mg}(\text{OH})_2$$

8,7 g magnesio hidroxido eratuko dira.

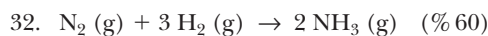
ERREAKZIO KIMIKOEN ETEKINA



$$M (\text{C}) = 12 \text{ g} \cdot \text{mol}^{-1}$$

$$55 \text{ g } \cancel{\text{ikatz}} \frac{88 \text{ g } \cancel{\text{karbono}}}{100 \text{ g } \cancel{\text{ikatz}}} \cdot \frac{1 \text{ mol } \cancel{\text{karbono}}}{12 \text{ g } \cancel{\text{karbono}}} \cdot \frac{1 \text{ mol } \cancel{\text{CO}_2}}{1 \text{ mol } \cancel{\text{karbono}}} \cdot \frac{22,4 \text{ L } \text{CO}_2}{1 \text{ mol } \cancel{\text{CO}_2}} = 90,3 \text{ L } \text{CO}_2$$

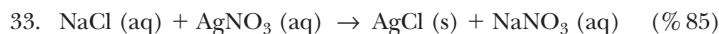
90,3 L CO_2 lortuko dira, ENean neurtuta.



$$M (\text{NH}_3) = 17 \text{ g} \cdot \text{mol}^{-1}$$

$$50 \text{ L } \cancel{\text{N}_2} \frac{1 \text{ mol } \cancel{\text{N}_2}}{22,4 \text{ L } \cancel{\text{N}_2}} \cdot \frac{2 \text{ mol } \cancel{\text{NH}_3}}{1 \text{ mol } \cancel{\text{N}_2}} \cdot \frac{17 \text{ g } \cancel{\text{NH}_3}}{1 \text{ mol } \cancel{\text{NH}_3}} \cdot \frac{60 \text{ g } \text{erreal}}{100 \text{ g } \text{teoriko}} = 45,5 \text{ g } \text{NH}_3$$

45,5 g amoniako lor daitezke.



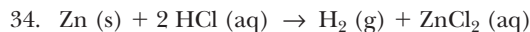
$V = 10 \text{ mL}$

1 M

$M (\text{AgCl}) = 143,4 \text{ g} \cdot \text{mol}^{-1}$

$$10 \text{ mL disoluzio} \cdot \frac{1 \cancel{\text{L}}}{1000 \text{ mL}} \cdot \frac{1 \text{ mol NaCl}}{1 \text{ L disoluzio}} \cdot \frac{1 \text{ mol AgCl}}{1 \text{ mol NaCl}} \cdot \frac{143,4 \text{ g AgCl}}{1 \text{ mol AgCl}} \cdot \frac{85 \text{ g erreal}}{100 \text{ g teoriko}} = 1,2 \text{ g AgCl}$$

Zilar kloruroaren 1,2 g-ko masa lortuko dugu.



$m = 150 \text{ g}$

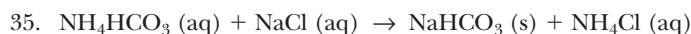
Masaren % 70

$M (\text{HCl}) = 36,5 \text{ g} \cdot \text{mol}^{-1}$

$$150 \text{ g sulfuran} \cdot \frac{70 \text{ g HCl}}{100 \text{ g sulfuran}} \cdot \frac{1 \text{ mol HCl}}{36,5 \text{ g HCl}} \cdot \frac{1 \text{ mol H}_2}{2 \text{ mol HCl}} \cdot \frac{22,4 \text{ L H}_2}{1 \text{ mol H}_2} = 32,2 \text{ L H}_2$$

32,2 L hidrogeno (gasa) lortuko ditugu, ENean neurtuta.

MATERIALEN EKOIZPEN INDUSTRIALA



$V = 100 \text{ L}$

2 M

$M (\text{NaHCO}_3) = 84 \text{ g} \cdot \text{mol}^{-1}$

$$100 \text{ L disoluzio} \cdot \frac{2 \text{ mol NH}_4\text{HCO}_3}{1 \text{ L disoluzio}} \cdot \frac{1 \text{ mol NaHCO}_3}{1 \text{ mol NH}_4\text{HCO}_3} \cdot \frac{84 \text{ g NaHCO}_3}{1 \text{ mol NaHCO}_3} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} = 16,8 \text{ kg NaHCO}_3$$

16,8 kg sodio bikarbonato lor daitezke.



$m = 25 \text{ kg}$

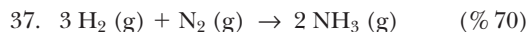
Masaren % 85

$M (\text{NaHCO}_3) = 84 \text{ g} \cdot \text{mol}^{-1}$

$M (\text{Na}_2\text{CO}_3) = 106 \text{ g} \cdot \text{mol}^{-1}$

$$25 \text{ kg NaHCO}_3 \cdot \frac{1000 \text{ g}}{1 \text{ kg}} \cdot \frac{85 \text{ g erreal}}{100 \text{ g teoriko}} \cdot \frac{1 \text{ mol NaHCO}_3}{84 \text{ g NaHCO}_3} \cdot \frac{1 \text{ mol Na}_2\text{CO}_3}{2 \text{ mol NaHCO}_3} \cdot \frac{106 \text{ g Na}_2\text{CO}_3}{1 \text{ mol Na}_2\text{CO}_3} \cdot \frac{1 \text{ kg}}{1000 \text{ g}} = 13,4 \text{ kg Na}_2\text{CO}_3$$

13,4 kg sodio karbonato lor daitezke.



$V = 100 \text{ L}$

$T = 400 \text{ }^\circ\text{C} + 273 = 673 \text{ K}$

$P = 900 \text{ atm}$

$$n (\text{H}_2) = \frac{PV}{RT} = \frac{900 \text{ atm} \cdot 100 \cancel{\text{L}}}{0,082 \text{ atm} \cdot \cancel{\text{L}} \cdot \cancel{\text{K}}^{-1} \cdot \text{mol}^{-1} \cdot 673 \cancel{\text{K}}} = 1630,8 \text{ mol H}_2$$

$$1630,8 \text{ mol H}_2 \cdot \frac{2 \text{ mol NH}_3}{3 \text{ mol H}_2} \cdot \frac{22,4 \cancel{\text{L}} \text{ NH}_3}{1 \text{ mol NH}_3} \cdot \frac{70 \text{ L erreal}}{100 \text{ L teoriko}} = 17048 \text{ L NH}_3$$

17048 L amoniako lor daitezke, egoera normalean neurtuta.