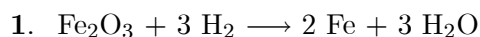
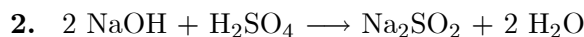


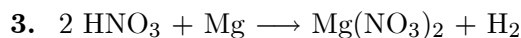
ESTEQUIOMETRIA SOLUCIONS



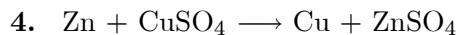
$$20 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{160 \text{ g Fe}_2\text{O}_3} \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{56 \text{ g Fe}}{1 \text{ mol Fe}} = 14 \text{ g Fe}$$



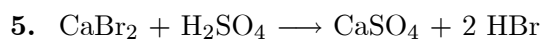
$$0,2 \text{ L dis} \times \frac{0,25 \text{ mol H}_2\text{SO}_4}{1 \text{ L dis}} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \times \frac{40 \text{ g NaOH}}{1 \text{ mol NaOH}} = 4,0 \text{ g NaOH}$$



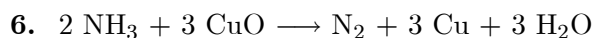
$$0,25 \text{ L dis} \times \frac{0,4 \text{ mol HNO}_3}{1 \text{ L dis}} \times \frac{1 \text{ mol H}_2}{2 \text{ mol HNO}_3} \times \frac{22,4 \text{ L H}_2}{1 \text{ mol H}_2} = 1,12 \text{ L H}_2$$



$$0,27 \text{ L dis} \times \frac{0,6 \text{ mol CuSO}_4}{1 \text{ L dis}} \times \frac{1 \text{ mol Zn}}{1 \text{ mol CuSO}_4} \times \frac{65,3 \text{ g Zn}}{1 \text{ mol Zn}} = 10,6 \text{ g Zn}$$



$$60 \text{ g CaBr}_2 \times \frac{1 \text{ mol CaBr}_2}{200 \text{ g CaBr}_2} \times \frac{2 \text{ mol HBr}}{1 \text{ mol CaBr}_2} \times \frac{22,4 \text{ L HBr}}{1 \text{ mol HBr}} = 13,44 \text{ L HBr}$$

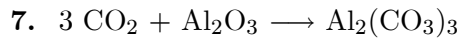


Com que hi ha dues quantitats s'ha buscar el reactiu limitant, és a dir: el que doni menys quantitat de productes.

$$68 \text{ g NH}_3 \times \frac{1 \text{ mol NH}_3}{17 \text{ g NH}_3} \times \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} = 2 \text{ mol N}_2$$

$$358 \text{ g CuO} \times \frac{1 \text{ mol CuO}}{79,5 \text{ g CuO}} \times \frac{1 \text{ mol N}_2}{3 \text{ mol CuO}} = 1,5 \text{ mol N}_2$$

$$1,5 \text{ mol N}_2 \times \frac{24,5 \text{ L N}_2}{1 \text{ mol N}_2} = 36,75 \text{ L N}_2$$



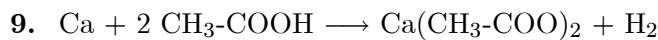
$$8,96 \text{ L CO}_2 \times \frac{1 \text{ mol CO}_2}{22,4 \text{ L CO}_2} \times \frac{1 \text{ mol Al}_2(\text{CO}_3)_3}{3 \text{ mol CO}_2} = 0,133 \text{ mol Al}_2(\text{CO}_3)_3$$

$$10,2 \text{ g Al}_2\text{O}_3 \times \frac{1 \text{ mol Al}_2\text{O}_3}{102 \text{ g Al}_2\text{O}_3} \times \frac{1 \text{ mol Al}_2(\text{CO}_3)_3}{1 \text{ mol Al}_2\text{O}_3} = 0,1 \text{ mol Al}_2(\text{CO}_3)_3$$

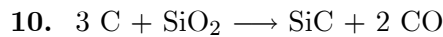
$$0,1 \text{ mol Al}_2(\text{CO}_3)_3 \times \frac{234 \text{ g Al}_2(\text{CO}_3)_3}{1 \text{ mol Al}_2(\text{CO}_3)_3} = 23,4 \text{ g Al}_2(\text{CO}_3)_3$$



$$0,5 \text{ L dis} \times \frac{0,2 \text{ mol NH}_3}{1 \text{ L dis}} \times \frac{1 \text{ mol HCl}}{1 \text{ mol NH}_3} \times \frac{36,5 \text{ g HCl}}{1 \text{ mol HCl}} \times \frac{100 \text{ g dis}}{40 \text{ g HCl}} \times \frac{1 \text{ mL dis}}{1,25 \text{ g dis}} = 7,3 \text{ mL dis}$$



$$11,2 \text{ L H}_2 \times \frac{1 \text{ mol H}_2}{22,4 \text{ L H}_2} \times \frac{2 \cdot 100 \text{ mol CH}_3\text{-COOH}}{1 \cdot 50 \text{ mol H}_2} \times \frac{1 \text{ L dis}}{0,5 \text{ mol CH}_3\text{-COOH}} = 4,0 \text{ L dis}$$



$$1000 \text{ g sorra} \times \frac{90 \text{ g SiO}_2}{100 \text{ g sorra}} \times \frac{1 \text{ mol SiO}_2}{60 \text{ g SiO}_2} \times \frac{3 \text{ mol C}}{1 \text{ mol SiO}_2} \times \frac{12 \text{ g C}}{1 \text{ mol C}} \times \frac{100 \text{ g carbó}}{80 \text{ g C}} = 675 \text{ g carbó}$$

11. Calculem els mols i la massa de C i restant-la del total obtenim l'H

$$2,97 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} = 0,0675 \text{ mol C} \quad \times \frac{12 \text{ g C}}{1 \text{ mol C}} = 0,81 \text{ g C}$$

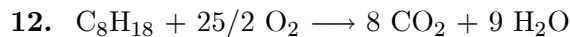
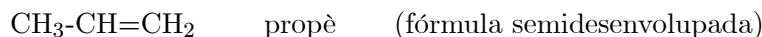
$$0,945 \text{ g total} - 0,81 \text{ g C} = 0,135 \text{ g H} \quad \times \frac{1 \text{ mol H}}{1 \text{ g H}} = 0,135 \text{ mol H}$$

$$\text{C:H} = \frac{0,0675 \text{ mol C}}{0,0675} : \frac{0,135 \text{ mol H}}{0,0675} = 1 \text{ mol C} : 2 \text{ mol H} = \text{CH}_2 \quad (\text{fórmula empírica})$$

$$M(\text{CH}_2) = 14 \text{ g/fórmula} \quad d = \frac{PM}{RT} \quad M = \frac{dRT}{P} = \frac{1,72 \cdot 0,082 \cdot 298}{1} = 42 \text{ g/mol}$$

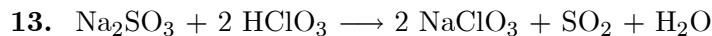
$$\frac{42 \text{ g/mol}}{14 \text{ g/fórmula}} = 3 \text{ fórmula/mol} \quad 3 \times (\text{CH}_2) = \text{C}_3\text{H}_6 \quad (\text{fórmula molecular})$$

Per arribar a $2n + 2 = 8$, falten 2 H, per tant té una insaturació:



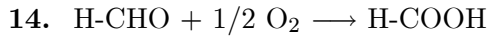
$$1 \text{ L C}_8\text{H}_{18} \times \frac{0,001 \text{ m}^3}{1 \text{ L}} \times \frac{712,5 \text{ kg}}{1 \text{ m}^3} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{1 \text{ mol C}_8\text{H}_{18}}{114 \text{ g C}_8\text{H}_{18}} \times \frac{8 \text{ mol CO}_2}{1 \text{ mol C}_8\text{H}_{18}} = 50 \text{ mol CO}_2$$

$$V = \frac{nRT}{P} = \frac{50 \cdot 0,082 \cdot 600}{779/760} = 2400 \text{ L CO}_2$$



$$0,4 \text{ L dis} \times \frac{0,5 \text{ mol HClO}_3}{1 \text{ L dis}} \times \frac{1 \text{ mol SO}_2}{2 \text{ mol HClO}_3} = 0,1 \text{ mol SO}_2$$

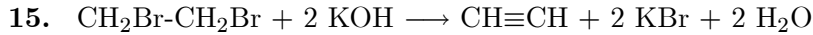
$$V = \frac{nRT}{P} = \frac{0,1 \cdot 0,082 \cdot 400}{0,82} = 4 \text{ L SO}_2 \quad \times \frac{100 \text{ L SO}_2 \text{ impur}}{80 \text{ L SO}_2} = 5 \text{ L SO}_2 \text{ impur}$$



$$4,9 \text{ L O}_2 \times \frac{1 \text{ mol O}_2}{24,5 \text{ L O}_2} \times \frac{1 \text{ mol H-CHO}}{0,5 \text{ mol O}_2} \times \frac{30 \text{ g H-CHO}}{1 \text{ mol H-CHO}} \times \frac{100 \text{ g dis}}{50 \text{ g H-CHO}} \times \frac{1 \text{ mL dis}}{0,8 \text{ g dis}} = 30 \text{ mL dis}$$

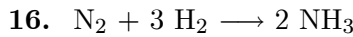
S'ha utilitzat el volum molar en c. e. (24,5 L).

No s'ha d'emprar el rendiment (tots dos són reactius)



$$10 \text{ L acetilè} \times \frac{80 \text{ L CH}\equiv\text{CH}}{100 \text{ L acetilè}} = 8 \text{ L CH}\equiv\text{CH} \quad n = \frac{PV}{RT} = \frac{1,23 \cdot 8}{0,082 \cdot 300} = 0,4 \text{ mol CH}\equiv\text{CH}$$

$$0,4 \text{ mol CH}\equiv\text{CH} \times \frac{2 \cdot 100 \text{ mol KOH}}{1 \cdot 50 \text{ mol CH}\equiv\text{CH}} \times \frac{56 \text{ g KOH}}{1 \text{ mol KOH}} \times \frac{100 \text{ g dis}}{40 \text{ g KOH}} \times \frac{1 \text{ mL dis}}{1,12 \text{ g dis}} = 200 \text{ mL dis}$$



$$1,6 \text{ mol N}_2 \times \frac{2 \cdot 75 \text{ mol NH}_3}{1 \cdot 100 \text{ mol N}_2} = 2,4 \text{ mol NH}_3 \quad 2,4 \text{ mol H}_2 \times \frac{2 \cdot 75 \text{ mol NH}_3}{3 \cdot 100 \text{ mol H}_2} = 1,2 \text{ mol NH}_3$$

L'hidrogen és el limitant i es formaran 1,2 mol d'amoníac.

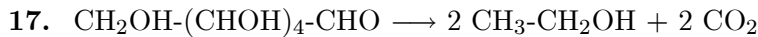
Calculem, ara, els mols que han reaccionat (no els que hi havia) de N_2 i H_2 :

$$1,2 \text{ mol NH}_3 \times \frac{1 \text{ mol N}_2}{2 \text{ mol NH}_3} = 0,6 \text{ mol N}_2 \quad 1,2 \text{ mol NH}_3 \times \frac{3 \text{ mol H}_2}{2 \text{ mol NH}_3} = 1,8 \text{ mol H}_2$$

Així doncs, els mols que quedaran després de reaccionar seran:

$$1,6 - 0,6 = 1 \text{ mol N}_2 \quad 2,4 - 1,8 = 0,6 \text{ mol H}_2 \quad \dots i \quad 1,2 \text{ mol NH}_3$$

$$n = 1 + 0,6 + 1,2 = 2,8 \text{ mol gasos} \quad P = \frac{nRT}{V} = \frac{2,8 \cdot 0,082 \cdot 500}{4,1} = 28 \text{ atm}$$



$$575 \text{ mL cava} \times \frac{12 \text{ mL alc}}{100 \text{ mL cava}} \times \frac{0,8 \text{ g alc}}{1 \text{ mL alc}} \times \frac{1 \text{ mol alc}}{46 \text{ g alc}} \times \frac{2 \text{ mol CO}_2}{2 \text{ mol alc}} = 1,2 \text{ mol CO}_2$$

$$V = \frac{nRT}{P} = \frac{1,2 \cdot 0,082 \cdot 300}{0,984} = 30 \text{ L CO}_2$$

18. Calculem els mols i la massa de C i H i restant-les del total obtenim l'O

$$39,6 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44 \text{ g CO}_2} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} = 0,9 \text{ mol C} \quad \times \frac{12 \text{ g C}}{1 \text{ mol C}} = 10,8 \text{ g C}$$

$$5,4 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ g H}_2\text{O}} \times \frac{2 \text{ mol H}}{1 \text{ mol H}_2\text{O}} = 0,6 \text{ mol H} \quad \times \frac{1 \text{ g H}}{1 \text{ mol H}} = 0,6 \text{ g H}$$

$$30,6 \text{ g total} - 10,8 \text{ g C} - 0,6 \text{ g H} = 19,2 \text{ g O} \quad \times \frac{1 \text{ mol O}}{16 \text{ g O}} = 1,2 \text{ mol O}$$

$$\text{C:H:O} = \frac{0,9 \text{ mol C}}{0,6} : \frac{0,6 \text{ mol H}}{0,6} : \frac{1,2 \text{ mol O}}{0,6} = 1,5 \text{ mol C} : 1 \text{ mol H} : 2 \text{ mol O} =$$

$$3 \text{ mol C} : 2 \text{ mol H} : 4 \text{ mol O} = \text{C}_3\text{H}_2\text{O}_4 \quad (\text{fórmula empírica})$$

$$M(\text{C}_3\text{H}_2\text{O}_4) = 102 \text{ g/fórmula} \quad M = \frac{mRT}{PV} = \frac{30,6 \cdot 0,082 \cdot 453}{0,0197 \cdot 283} = 204 \text{ g/mol}$$

$$\frac{204 \text{ g/mol}}{102 \text{ g/fórmula}} = 2 \text{ fórmula/mol} \quad 2 \times (\text{C}_3\text{H}_2\text{O}_4) = \text{C}_6\text{H}_4\text{O}_8 \quad (\text{fórmula molecular})$$

Per arribar a $2n + 2 = 14$, falten 10 H, per tant té 5 insaturacions:

$\text{COOH-C}(\text{COOH})=\text{C}(\text{COOH})-\text{COOH}$ àcid dicarboxibutendioic.

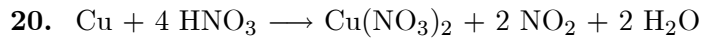


Suposem que el rendiment és x i anomenem "tetra" al producte

$$70 \text{ L gas} \times \frac{80 \text{ L F}_2}{100 \text{ L gas}} \times \frac{1 \text{ mol F}_2}{22,4 \text{ L F}_2} \times \frac{1 \cdot x \text{ mol tetra}}{2 \cdot 100 \text{ mol F}_2} = 0,0125x \text{ mol tetra}$$

$$4 \text{ L dis} \times \frac{0,45 \text{ mol etí}}{1 \text{ L dis}} \times \frac{1 \cdot x \text{ mol tetra}}{1 \cdot 100 \text{ mol etí}} = 0,018x \text{ mol tetra} \quad \text{el F}_2 \text{ és el reactiu limitant}$$

$$0,0125x \text{ mol tetra} \times \frac{102 \text{ g tetra}}{1 \text{ mol tetra}} = 91,8 \text{ g tetra} \quad x = \frac{91,8}{0,0125 \cdot 102} = 72 \%$$



$$19,85 \text{ g coure} \times \frac{80 \text{ g Cu}}{100 \text{ g coure}} \times \frac{1 \text{ mol Cu}}{63,5 \text{ g Cu}} \times \frac{2 \cdot 90 \text{ mol NO}_2}{1 \cdot 100 \text{ mol Cu}} = 0,45 \text{ mol NO}_2$$

$$70 \text{ mL dis} \times \frac{1,2 \text{ g dis}}{1 \text{ mL dis}} \times \frac{60 \text{ g HNO}_3}{100 \text{ g dis}} \times \frac{1 \text{ mol HNO}_3}{63 \text{ g HNO}_3} \times \frac{2 \cdot 90 \text{ mol NO}_2}{4 \cdot 100 \text{ mol HNO}_3} = 0,36 \text{ mol NO}_2$$

L'àcid nítric és el reactiu limitant, continuem a partir dels seus càlculs:

$$V = \frac{nRT}{P} = \frac{0,36 \cdot 0,082 \cdot 240}{0,984} = 7,2 \text{ L NO}_2 \quad \times \frac{100 \text{ L NO}_2 \text{ impur}}{72 \text{ L NO}_2} = 10 \text{ L NO}_2 \text{ impur}$$