Chemisch rekenen : Bepaling chemische formules

Oef 1

NH_4NO_3 → m %

N	H	O
2 mol	4 mol	3 mol

$m(N) = 2 \cdot 14,01 = 28,02\ g$

$m(H) = 4 \cdot 1,01 = 4,04\ g$

$m(O) = 3 \cdot 16,0 = 48\ g$

} $m(NH_4NO_3) = 80,06\ g$

$$m\%(N) = \frac{100 \cdot M(N)}{m} = \frac{100 \cdot 28,02}{80,06} = 35,0\ \%$$

$$m\%(H) = \frac{100 \cdot 4,04}{80,06} = 5,05\ \%$$

$$m\%(O) = \frac{100 \cdot 48}{80,06} = 59,96\ \%$$

Oef 2

$m\%(N) = 35,0\ \%$

$m(NH_4NO_3) = 48,5\ g$

$$m(N) = \frac{m\%(N) \cdot m(NH_4NO_3)}{100} = \frac{0,350 \cdot 48,5\ g}{100} = 16,98\ g$$

Oef 3

$m(\text{asijnzuur}) = 4,24 \cdot 10^{-3}\ g$

$m(CO_2) = 6,21 \cdot 10^{-3}\ g$

$m(H_2O) = 2,54 \cdot 10^{-3}\ g$

C	O	H
1 mol	3 mol	2 mol

- $m(C) = 1 \cdot 12,01 = 12,01\ g$
  $m(O) = 2\ mol \cdot 16,0\ g/mol = 32,0\ g$ } $44,01\ g$
- $m(C) = 12,01 : 44,01 \cdot 6,21 \cdot 10^{-3}$
  $= 1,69 \cdot 10^{-3}\ g$
  $m(O) = 32,0 : 44,01 \cdot 6,21 \cdot 10^{-3}$
  $= 4,51 \cdot 10^{-3}\ g$
- $m(H) = 2\ mol \cdot 1,01\ g/mol$
  $= 2,02\ g$
  $m(O) = 1\ mol \cdot 16,0\ g/mol$ } $18,02\ g$
  $= 16,0\ g$
- $m(H) = 2,02 : 18,02 \cdot 2,54 \cdot 10^{-3}$
  $= 0,28 \cdot 10^{-3}\ g$
  $m(O) = 16,0 : 18,02 \cdot 2,54 \cdot 10^{-3}$
  $= 2,26 \cdot 10^{-3}\ g$
- $m\%(C) = \frac{100 \cdot m(C)}{m} = \frac{100 \cdot 1,69 \cdot 10^{-3}}{4,24 \cdot 10^{-3}} = 39,86\%$
  $m\%(H) = \frac{100 \cdot m(H)}{m} = \frac{100 \cdot 0,28 \cdot 10^{-3}}{4,24 \cdot 10^{-3}} = 6,60\%$
  $m\%(O) = 100\% - 39,86\% - 6,60\%$
  $= 54\%$

Úloha 4

$m(X) = 1,587\ g$
$m(N) = 0,483\ g$
$m(O) = 1,104\ g$

- $n(N) = \frac{m}{M} = \frac{0,483\ g}{14,01\ g/mol} = 0,0345\ mol \rightarrow 1$

- $n(O) = \frac{m}{M} = \frac{1,104\,g}{16,0\,g/mol} = 0,069\,mol \rightarrow 2$

Empirische Formule: NO_2

Oef 5

$m\%(Na) = 17,5\%$

$m\%(Cr) = 39,7\%$

$m\%(O) = 42,8\%$

- $n(Na) = \frac{m}{M} = \frac{17,5\,g}{22,99\,g/mol} = 0,762\,mol \rightarrow 1$
- $n(Cr) = \frac{39,7\,g}{52,0\,g/mol} = 0,763\,mol \rightarrow 1$
- $n(O) = \frac{m}{M} = \frac{42,8\,g}{16,0\,g/mol} = 2,675\,mol \rightarrow 3,5$

Empirische Formule: $Na_2Cr_2O_7$

Oef 6

- $m\%(C) = 68,8\%$
  $m\%(H) = 5,0\%$
  $m\%(O) = 26,2\%$
  } 100 g
- $n(C) = \frac{m}{M} = \frac{68,8\,g}{12,01\,g/mol} = 5,73\,mol \rightarrow 3,5$
- $n(O) = \frac{m}{M} = \frac{26,2\,g}{16,0\,g/mol} = 1,64\,mol \rightarrow 1$
- $n(H) = \frac{m}{M} = \frac{5,0\,g}{1,01\,g/mol} = 4,95\,mol \rightarrow 3$

Empirische Formule: $C_7H_6O_2$

Oef 7

- m % (C) = 39,9 %
  m % (H) = 6,7 %
  m % (O) = 53,4 %
  } 100 g

- $n(C) = \frac{m}{M} = \frac{39,9\ g}{12,01\ g/mol} = 3,32\ mol \rightarrow 1$

- $n(H) = \frac{m}{M} = \frac{6,7\ g}{1,01\ g/mol} = 6,6\ mol \rightarrow 2$

- $n(O) = \frac{53,4\ g}{16,0\ g/mol} = 3,34\ mol \rightarrow 1$

Empirische formule: CH_2O

Molecuulformule: $\frac{M}{M_E} = \frac{60,0\ g/mol}{(12,01 + 2 \cdot 1,01 + 16)\ g/mol} = 2$

$C_2H_4O_2$

Oef 8

$M(x) = 176,12\ g/mol$

Empirische formule: $C_3H_4O_3$

Molecuulformule: $\frac{M}{M_E} = \frac{176\ g/mol}{(3 \cdot 12,01 + 4 \cdot 1,01 + 3 \cdot 16)\ g/mol} = 2$

$C_6H_8O_6$

Oef 9

- C_2H_4 (etheen)

$m(C) = 12 \cdot 2 = 24\,g$

$m(H) = 4 \cdot 1{,}01 = 4{,}04\,g$ } $28{,}04\,g$

$m\%(C) = \frac{24\,g}{28{,}04\,g} \cdot 100 = 86\%$

- C_3H_7OH (propanol)

$m(C) = 12 \cdot 3 = 36\,g$

$m(H) = 8 \cdot 1{,}01 = 8{,}08\,g$ } $60{,}08\,g$

$m(O) = 16\,g$

$m\%(C) = \frac{36\,g \cdot 100}{60{,}08\,g} = 60\%$

- C_7H_{16} (heptaan)

$m(C) = 12 \cdot 7 = 84\,g$ } $100{,}16\,g$

$m(H) = 16 \cdot 1{,}01 = 16{,}16\,g$

$m\%(C) = \frac{84\,g \cdot 100}{100{,}16\,g} = 84\%$

Etheen > heptaan > propanol

Oef 10

$M(KBr) = 19{,}00\,g/mol$

$M(K_2S) = 110{,}26\,g/mol$

$m(KBr) + m(K_2S) = 8{,}02\,g$

$m(K) = 4{,}50\,g$

$n(K) = 0{,}115\,mol$

x = A mol KBr

y = A mol K_2S

$$\Rightarrow \begin{cases} x + 2y = 0{,}115 \text{ mol} \\ x \cdot 119 \text{ g/mol} + y \cdot 110{,}26 \text{ g/mol} = 8{,}02 \text{ g} \end{cases}$$

$x = 2{,}6 \cdot 10^{-2}$ mol

$$m\,\%\,(KBr) = \frac{100 \cdot n \cdot M(Br)}{8{,}02 \text{ g}}$$

$= 39\,\%$