Obecná chemie #5 | ROZTOKY |

① 20% H_3PO_4 ($\rho = 1{,}1134\ g/cm^3$) $V = ?$ $V(H_2O) = ?$
80% H_3PO_4 ($\rho = 1{,}6330\ g/cm^3$) $900\ cm^3$

$m(H_3PO_4) = \rho \cdot V \cdot w = 1175{,}76\ g$

$M(20\%) = \frac{m}{w} = 5878{,}8\ g$

$\Rightarrow V(20\%) = \frac{M}{\rho} \doteq 5280{,}4\ cm^3$

$V(H_2O) = \frac{m(H_2O)}{\rho} = \frac{5878{,}8\ g - 1175{,}76\ g}{1\ g/cm^3} = 4703\ cm^3$

Lijeme kyselinu do vody!

② $450\ cm^3$ 11M H_2SO_4 ($1{,}5874\ g/cm^3$) $M(H_2SO_4) = 98$
$250\ cm^3$ 15% H_2SO_4 ($1{,}1020\ g/cm^3$)
koncentrace fin. roztoku ($w =$) ?

$250\ cm^3 \cdot 1{,}1020\ g/cm^3 \cdot 0{,}15 = 41{,}325\ g\ H_2SO_4$ v $250\ cm^3$
$V \cdot \rho \cdot w$

$c = \frac{n}{V}$ $\quad m = M \cdot n = M \cdot c \cdot V$

$98\ g/mol \cdot 11\ mol/dm^3 \cdot 0{,}450\ dm^3 = 485{,}1\ g\ H_2SO_4$

$\Rightarrow 41{,}325 + 485{,}1 \doteq 526{,}4\ g$ celk. H_2SO_4

celk. fin roztoku: $m = \rho \cdot V$

$450 \cdot 1,1384 + 250 \cdot 1,1020 = 797,03\,g$

$$w(H_2SO_4) = \frac{526,4}{989,83} \doteq 0,531 \Rightarrow \underline{53,1\%}$$

③ 96% H_2SO_4 + voda $\Rightarrow$ 10% H_2SO_4
($1,836\,g/cm^3$)

směšovací rce: $m_1w_1 + m_2w_2 = m_3w_3$ (1)

$m_1 + m_2 = m_3$ (2)

z (1): $0,96\,m_1 + 0 \cdot m_2 = 0,10\,m_3$

$m_3 = 9,6\,m_1$

do (2): $m_1 + m_2 = 9,6\,m_1$

$m_2 = 8,6\,m_1$

$\frac{m_2}{m_1} = 8,6$

$m = \rho \cdot V$:

$$\frac{\rho_2 V_2}{\rho_1 V_1} = 8,6 \Rightarrow \frac{V_2}{V_1} = 8,6 \cdot \frac{\rho_1}{\rho_2} = 8,6\,\frac{1,836}{1}$$

$$\underline{V_2 : V_1 \doteq 15,8 : 1}$$

Součin rozpustnosti

$A_rB_s \rightarrow rA^+ + sB^-$ $\quad K_S = [A^+]^r \cdot [B^-]^s$

koncentrace

pro slabé

$K_S = a^r(A^+) \cdot a^s(B^+)$

rozklady – aktivita

④ 100 cm³ $PbCrO_3$ $1{,}1 \cdot 10^{-5}$ g Pb^{2+} ($207{,}2 = A_r$)

$PbCrO_3 \rightarrow Pb^{2+} + CrO_3^{2-}$

$K_s = [Pb^{2+}][CrO_3^{2-}] = [Pb^{2+}]^2$

$K_s = \left(\frac{1{,}1 \cdot 10^{-5}}{207{,}2 \cdot 0{,}1}\right)^2 \doteq \underline{2{,}81 \cdot 10^{-3}}$

$c = \frac{n}{V} = \frac{m}{M \cdot V}$

⑤ 150 g ⊙ NaCl nasycený 20°C,

odpar 85,0 g vody, rozp. 36 g / 100 g

36 g .... 100 g

x g .... 85,0 g

$x = \frac{85}{100} \cdot 36 = \underline{30{,}6\,g}$

⑥ 500°C 932 kPa 3,71 g/cm³ sirné páry, vzorec?

$A_r(S) = 32{,}00$

$pV = nRT = \frac{m}{M}RT = \frac{\rho \cdot V}{M}RT$

R = 8,314 J/Kmol
molární plynová konstanta

$\Rightarrow M = \frac{\rho RT}{p}$

$M = \frac{3{,}71 \cdot 8{,}314 \cdot (500 + 273{,}15)}{93{,}200} \doteq 256\,g/mol$

256 / 32 ⇒ P ⇒ S_8

stavová rovnice

→ ideální plyn $pV = nRT$

→ van der Waals $\left(p + \frac{a^2}{V^2}\right) \cdot (V - nb) = nRT$

opravce na tlak — opravce na objem

⑦ $N_2 + 3H_2 \Rightarrow 2NH_3$

I:	2,5	1,5	0	$\Sigma = 4$
F:	2,0	0	1,0	$\Sigma = 3$

parciální tlaky před reakcí a po ní:

molární zlomek $x_i = \frac{n_i}{\Sigma_i n}$

parciální tlak $p_i = x_i p_{tot}$ $\quad p_i = \frac{n_i}{\Sigma n} \frac{\Sigma nRT}{V} = \frac{n_i RT}{V}$

I: $x_{N_2} = \frac{2,5}{4} \Rightarrow p_{N_2} = \frac{2,5 \cdot 8,314 \cdot 273\,K}{22,4} \doteq \underline{\underline{152\,kPa}}$

$x_{H_2} = \frac{1,5}{4} \Rightarrow p_{H_2} \doteq \underline{\underline{253\,kPa}}$ $\quad \sum_I = 405\,kPa$

$x_{NH_3} = 0$

F: $x_{N_2} = \frac{2}{3} \Rightarrow p_{N_2} = \underline{\underline{203\,kPa}}$

$x_{H_2} = 0$ $\quad \sum_I = 304\,kPa$

$x_{NH_3} = \frac{1}{3} \Rightarrow p_{NH_3} = \underline{\underline{101\,kPa}}$