Øving 3 - Vegard O. Jervell

1a) $\overset{B}{HSO_4^-} + \overset{S}{H_3O^+} \leftrightharpoons \overset{S}{H_2SO_4} + \overset{B}{H_2O}$

$\overset{S}{HSO_4^-} + \overset{B}{H_2O} \leftrightharpoons \overset{B}{SO_4^{2-}} + \overset{S}{H_3O^+}$

1b) 1) HNO_3 er en syre, NO_3^- er korr. base

2. HS^- er en base, H_2S er korr. syre

3. HF er en syre, F^- er korr. base.

1c) $\overset{S}{CH_3COOH} + \overset{B}{NH_3} \leftrightharpoons \overset{B}{CH_3COO^-} + \overset{S}{NH_4^+}$

2a) $-\log(x) = 1,5 \rightarrow x = 3,16 \cdot 10^{-2} = [H^+]$

2b) $-\log(0,01) = 4,6$ $\quad pH = 4,6$

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2c) $-\log(0,01) = 4,6$ $\underline{\underline{pOH = 4,6}}$

2d) $pH + pOH = 14$ $\underline{\underline{pH = 14 - 4,6 = 9,4}}$

2e) NaCl ~~gir ekstra~~ påvirker ikke protonbalansen i vann, derfor blir $[H^+] = [OH^-]_{vann} = \frac{K_w}{[H^+]} \rightarrow$

$\rightarrow \underline{\underline{[H^+] = 10^{-7}}}$

2f) $2H_2O \leftrightharpoons H_3O^+ + OH^-$

2g) $[OH^-] = 3 \cdot 10^{-2}\ mol/L \rightarrow pOH = -\log\frac{[OH^-]}{M} = 1,52$

$\underline{\underline{pH = 14 - 1,52 = 12,48}}$

$-\log\frac{[H_3O^+]}{M} = 12,48 \rightarrow [H_3O^+] = 3,8 \cdot 10^{-6}\ M$

Oppgave 24)

$$HAc_{(aq)} + H_2O_{(l)} \rightleftharpoons Ac^-_{(aq)} + H_3O^+_{(aq)}$$

24 i) $$K_a = \frac{[Ac^-][H_3O^+]}{[HAc]}$$

24 j) $K_a = 1{,}8 \cdot 10^{-5}$

24 k) $pK_a = 3 \rightarrow K_a = -\log(x) = 3 \rightarrow K_a = 10^{-3}$

$pK_a = -4 \rightarrow K_a = 10^4$

24 l) $[HAc] = [Ac^-] = 0{,}1\ M$

Ka Bufferlikningen gjelder

$$pH = pK_a + \log\left(\frac{[Base]}{[Syre]}\right)$$

$$\underline{\underline{pH = pK_a = 4{,}76}}$$

$$[A^-][H^+]$$

$pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Syre}]}\right)$

$\underline{pH = pK_a = 4{,}76}$

2m) $K_a = \frac{[A^-][H^+]}{[HA]}$

Brukes tabellmetode Hvor $[HA] - x \simeq [HA]$

$1{,}8 \cdot 10^{-5} = \frac{x^2}{0{,}1} \rightarrow \underline{x = 1{,}34 \cdot 10^{-3}}$

$pH = -\log(x)$

$\underline{pH = 6{,}62}$

2n) K_w og K_a er konstanter, pH varierer etter $[H^+]$

Øving 3, Vegard G. Jovell

Oppg 3)

$HF \leftrightharpoons F^-$ $pK_a = 3,17$

$HSO_4^- \leftrightharpoons SO_4^{2-}$ $pK_a = 1,99$

$HNO_2 \leftrightharpoons NO_2^-$ $pK_a = 3,15$

$CH_3COOH \leftrightharpoons CH_3COO^-$ $pK_a = 4,76$

SO_4^{2-}, NO_2^-, F^-, CH_3COO^-

$\longrightarrow$ $\longrightarrow$

Sterkere Base

4a) $pK_a = 3,86$ $K_a = 2,1068 \cdot 10^{-2}$

$K_a = \frac{[A^-][H^+]}{[HA]}$ $\rightarrow$ $2,1068 = \frac{x^2}{0,1-x}$ $\rightarrow x = 3,66 \cdot 10^{-2}$

$[H^+] = 3,66 \cdot 10^{-2}$ $\rightarrow$ $pH = 1,4$

$K_a = \frac{[H^+][A^-]}{[HA]}$ → $2,1068 = \frac{x^2}{0,1-x}$ → $x = 3,66 \cdot 10^{-2}$

$[H^+] = 3,66 \cdot 10^{-2}$ → $\underline{pH = 1,4}$

4b) Når $pH = pK_a$ er $[A^-] = [HA]$

Ved tabellmetoden blir da

$[A^-] = [HA]_0 - [HA]$ → $[A^-] = [HA] = \frac{1}{2}[HA]_0$

$pH = pK_a - 0,5$ → $\log \frac{[A^-]}{[HA]} = -0,5$ → $\frac{[A^-]}{[HA]} = \sqrt{10^{-1}}$

Ved tabellmetode er

$[A^-] = [HA]_0 - [HA]$ → $[A^-] = \frac{[HA]_0}{1 + \sqrt{10}}$

→ $[HA] = \frac{[HA]_0}{1 + \frac{1}{\sqrt{10}}}$

5a) $[H^+] = [OH^-]$

b) $[H^+] = [Cl^-] + [OH^-]$

c) $[H^+] = [HCOO^-] + [OH^-]$

d) $[H^+] = [OH^-] + [Ac^-] - [Na^+]$

d) $[H^+] = [OH^-] + [HSO_4^-] + 2 \cdot [SO_4^{2-}]$

6a) $2HCOOH \leftrightharpoons HCOO^- + HCOOH_2^+$

$[HCOO^-][HCOOH_2^+]$ $a_{HCOO^-} \cdot a_{HCOOH_2^+}$

5a)

a) $[H^+] = [OH^-]$

b) $[H^+] = [Cl^-] + [OH^-]$

c) $[H^+] = [HCOO^-] + [OH^-]$

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e) $[H^+] = [OH^-] + [HSO_4^-] + 2 \cdot [SO_4^{2-}]$

6a)

$$2HCOOH \leftrightharpoons HCOO^- + HCOOH_2^+$$

$$K_L = \frac{[HCOO^-][HCOOH_2^+]}{[L]} \qquad K_L = \frac{a_{HCOO^-} \cdot a_{HCOOH_2^+}}{(a_{HCOOH})^2}$$

aktivitet til rent løsemiddel = 1

$$K_L = a_{HCOO^-} \cdot a_{HCOOH_2^+}$$

$$a_{HCOOH_2^+} = \sqrt{K_L} = \sqrt{6,3 \cdot 10^{-4}}$$

$$pK_L = 6,2 \rightarrow K_L = 6,3 \cdot 10^{-7}$$

$$pH = -\log(a_{HCOOH_2^+}) = 3,1$$

(b) $2C_2H_5OH \leftrightarrows C_2H_5O^- + C_2H_5OH_2^+$

$$K_t = a_{C_2H_5O^-} \cdot a_{C_2H_5OH_2^+}$$

aktivitet tid rem $C_2H_5OH = 1$

$$K_t = \left(a_{C_2H_5OH_2^+}\right)^2$$

$$K_t = (1,58 \cdot 10^{-10})^2$$

$$K_t = 2,51 \cdot 10^{-20}$$

pH = 9,8

$$-\log\left(a_{C_2H_5OH_2^+}\right) = 9,8$$

$$a_{C_2H_5OH_2^+} = 1,58 \cdot 10^{-10}$$