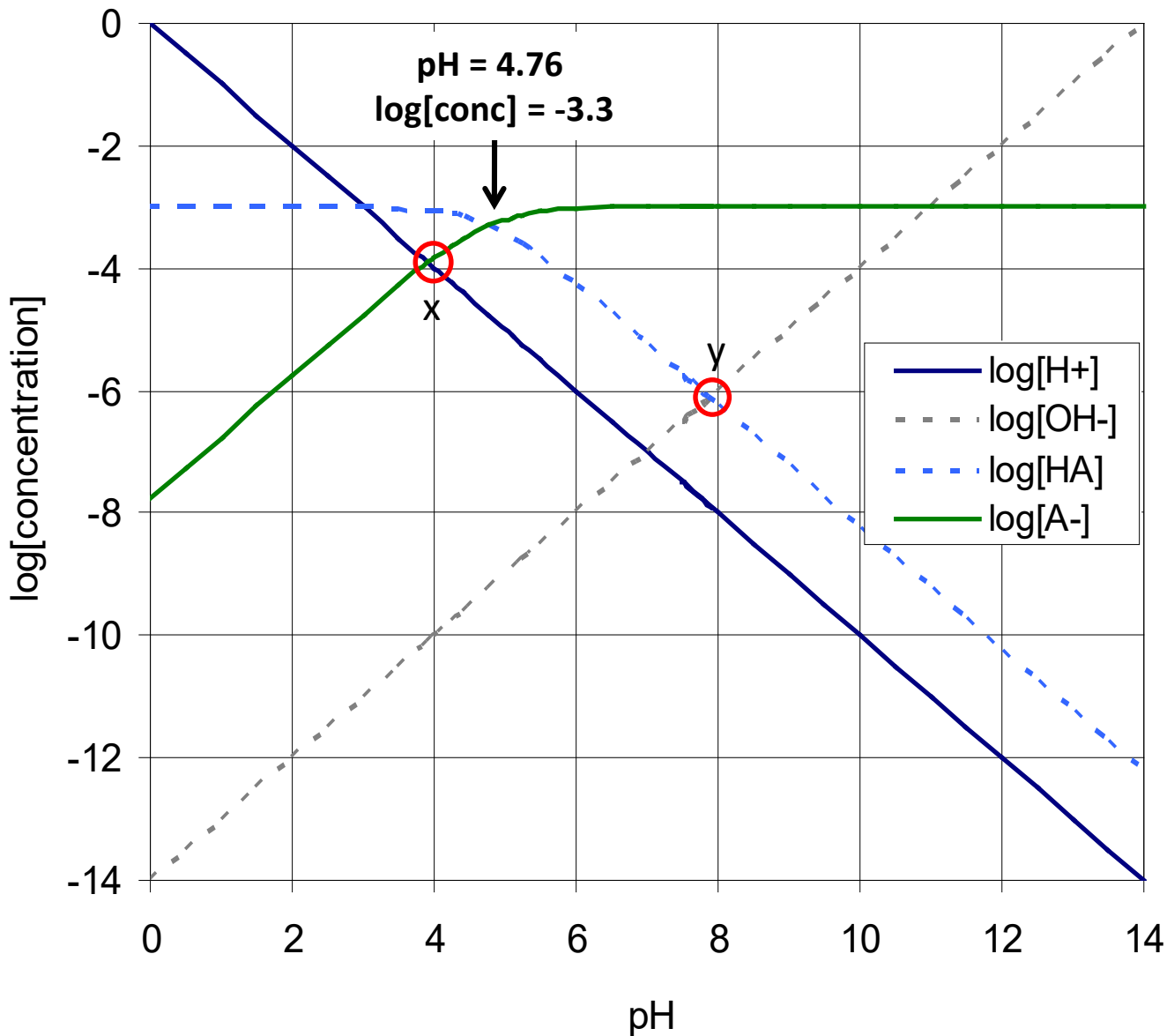


## Exercise 1 - solution



Equilibrium at point x:  $[\text{H}^+] = [\text{A}^-] + [\text{OH}^-] \approx [\text{A}^-]$  (added as HA)

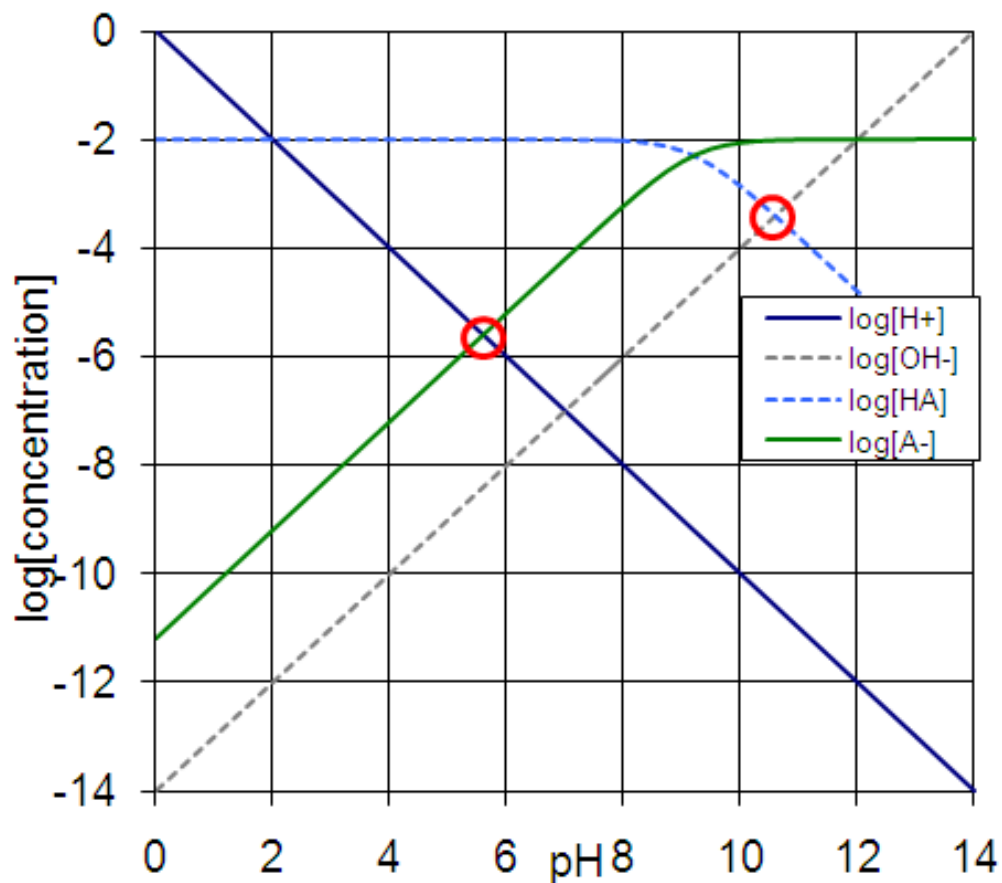
Equilibrium at point y:  $[\text{HA}] + [\text{H}^+] = [\text{OH}^-] \approx [\text{HA}]$  (added as NaA)

## Exercise 2 - solution

**Addition of hydrogen cyanide (HCN /  $\text{CN}^-$ ) to pure water.**

- What is the equilibrium pH if  $10^{-2}$  M HNC is added?
- What is the equilibrium pH if  $10^{-2}$  M  $\text{CN}^-$  is added?

Conditions:  $C_T = 10^{-2}$  M;  $T = 25$  °C;  $\text{pK}_a = 9.2$ ;  $\text{pK}_w = 14$

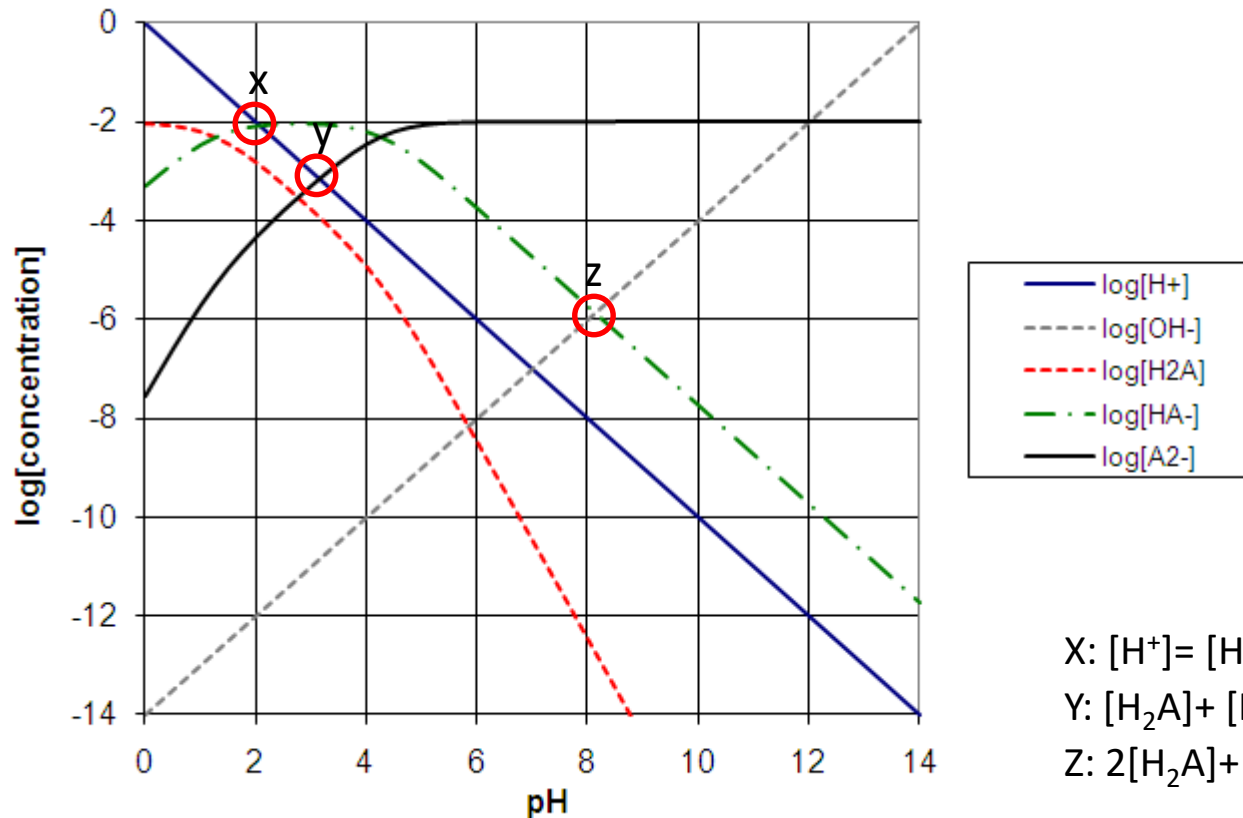


# Exercise 3 - solution

Addition of oxalic acid ( $\text{H}_2\text{A}=\text{H}_2\text{C}_2\text{O}_4$ ) to pure water.

- What is the equilibrium pH if  $10^{-2}$  M  $\text{H}_2\text{A}$  is added?
- What is the equilibrium pH if  $10^{-2}$  M  $\text{HA}^-$  is added?
- What is the equilibrium pH if  $10^{-2}$  M  $\text{A}^{2-}$  is added?

Conditions:  $C_T = 10^{-2}$  M;  $T = 25^\circ\text{C}$ ;  $\text{pK}_{a1}=1.27$ ;  $\text{pK}_{a2} = 4.27$ ;  $\text{pK}_W = 14$



X:  $[\text{H}^+] = [\text{HA}^-] + 2[\text{A}^{2-}] + [\text{OH}^-]$  if added as  $\text{H}_2\text{A}$

Y:  $[\text{H}_2\text{A}] + [\text{H}^+] = [\text{A}^{2-}] + [\text{OH}^-]$  if added as  $\text{HA}^-$

Z:  $2[\text{H}_2\text{A}] + [\text{HA}^-] + [\text{H}^+] = [\text{OH}^-]$  if added as  $\text{A}^{2-}$

## Exercise 4 - solution

Addition of silicic acid to pure water:  $\text{Si(OH)}_4 \leftrightarrow \text{SiO(OH)}_3^- \leftrightarrow \text{SiO}_2(\text{OH})_2^{2-}$

- What is the equilibrium pH if  $10^{-3}$  M  $\text{H}_2\text{A}$  is added?
- What is the equilibrium pH if  $10^{-3}$  M  $\text{HA}^-$  is added?

Conditions:  $C_T = 10^{-3}$  M;  $T = 25^\circ\text{C}$ ;  $\text{pK}_{a1} = 9.5$ ;  $\text{pK}_{a2} = 12.6$ ;  $\text{pK}_W = 14$

