Thomas and Thomas TS4

Bon travail, mais le TP n'avait pas été fait en entier lors de la séance. Pour la dernière partie, voir l'autre compte-rendu.

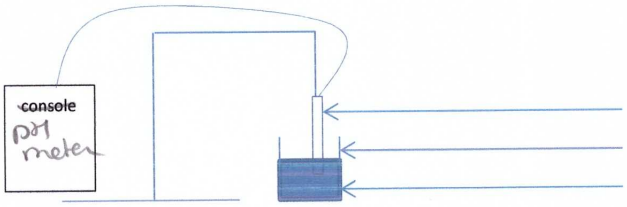
Lab work 1 : Some experiments with acis and bases

- Calibrate the pH meter

We use 2 buffers solutions (solution tampon) which have a pH of 7 and 4

And we measure the pH of the buffer solution with a pH meter.

~~After~~ then we check that the result is ~~according to~~ in accordance with the pH value of the buffer solution.



~~pH meter~~ probe (sonde).
Beaker
Buffer soution

Results :

- Buffer solution pH 7 : 6.9
- Buffersolution pH 4 : 3.87

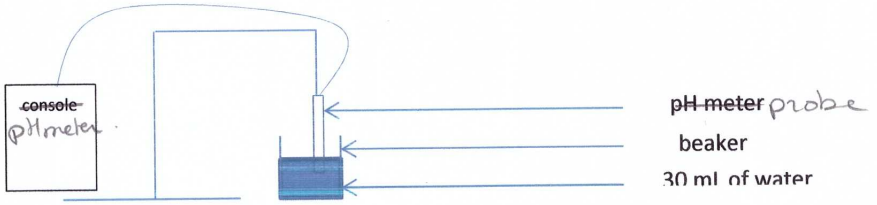
Conclusion :

Our results are ~~according to~~ in accordance with the pH of the buffer solution so we can conclude that our pH meter is correctly calibrated.

Experiment 1 : aqueous acidic solution

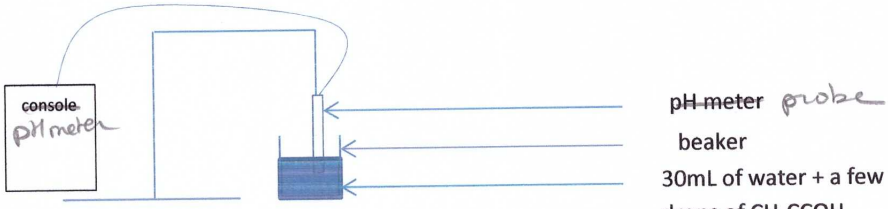
We measure the pH of about 30mL of water and we measure the pH of a solution composed by 30 mL of water and few drops of ethanoic acid (CH_3COOH) and we compare the results.

- pH for 30mL of water



We find pH equal 7

- pH for 30 mL of water and few drops of ethanoic acid



We find pH=3

The pH decreases which means that $[H_3O^+]$ increases so there is a production of H_3O^+, so a chemical reaction.

- Before :

$[H_3O^+]= 10^{-7}$ mol/L

- After :

$[H_3O^+]=10^{-3}$ mol/L

The reaction is immediate

Its equation is

$CH_3COOH(l) + H_2O(l) \rightarrow CH_3COO^-(aq) + H_3O^+(aq)$

Reactant products

The equation is in accordance with our measurements because H_3O^+ is produced.

(to pour = verser).

Experiment 2 :

- ~~for~~ pour about V=20 mL of this solution into a beaker and measure its pH :

pH = 3

- Calculate the maximum extent : x_{max}

x_{max} = n(CH_3COOH) because H_2O is in excess

n(CH_3COOH) = C*V = $1.0*10^{-2}*20*10^{-3}$

= $1.0*10^{-2}*2.0*10^{1}*10^{-3}$

= $2.0*10^{-4}$ mol

So $x_{max} = 2.0*10^{-4}$ mol

- Using the pH measured, calculate the real (or final) concentration in oxonium ions [H_3O^+]. Deduce the value of the final (or real) extent : x_f :

$[H_3O^+]_f = 10^{-3}$ mol/L

So $n(H_3O^+)_f = [H_3O^+]_f*V = 10^{-3}*20*10^{-3}$

= $20*10^{-6} = 2.0*10^{-5}$ mol

$n(CH_3COOH)_f = 2.0*10^{-4} - 2.0*10^{-5} = 2.0 - 0.20*10^{-4} = 1.80*10^{-4}$ mol

- Compare x_f and x_{max}. Is the reaction between ethanoic acid and water complete (total) or limited?

$x_f < x_{max}$, so the reaction between ethanoic acid and water is limited.

Equation	CH_3COOH (l)	+ H_2O (l)	CH_3COO^- (aq)	+ H_3O^+ (aq)
	Quantities (in mol)			
Initial (x = 0)	$2.0*10^{-4}$	excess	0	0
During the reaction	$2.0*10^{-4}$ - x	excess	x	x
At the maximum extent ($x = x_{max}$)	0	excess	$2.0*10^{-4}$	$2.0*10^{-4}$
At the real final extent ($x = x_f$)	$1.8*10^{-4}$	excess	$0.20*10^{-4}$	$0.20*10^{-4}$

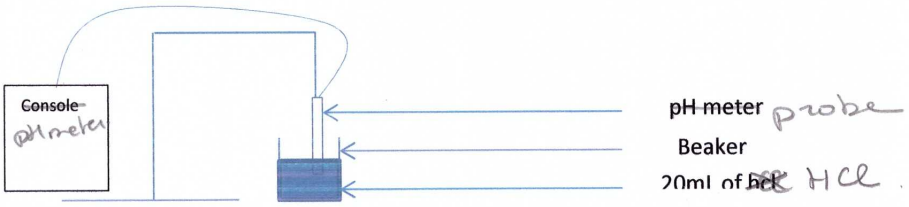
Experiment 3 :

We measure the pH of a solution of hydrochloric acid

We calculate the maximum extent: x_{max}

We calculate the real concentration in oxonium ions $[H_3O^+]$ and we deduce the value of the final extent: x_f

We compare x_f and x_{max} and we determine if the reaction between ethanoic acid and water is complete or limited.



We find pH=2

n= CxV

n(HCl)= $1,0.10^{-2}$ x $2,0.10^{-2}$ mol

n(HCl)= $2,0.10^{-4}$ mol

Equation	$HCl\ (g)$	$+ H_2O\ (l)$ ⇌	$Cl^-\ (aq)$	$+ H_3O^+\ (aq)$
	Quantities (in mol)			
Initial (x = 0)	$2.0*10^{-4}$	excess	0	0
During the reaction	$2.0*10^{-4}$ - x	excess	x	x
At the maximum extent ($x = x_{max}$)	0	excess	$2.0*10^{-4}$	$2.0*10^{-4}$
At the real final extent ($x = x_f$)	0	excess	$2.0*10^{-4}$	$2.0*10^{-4}$

$[H_3O^+]_f = 10^{-2}$ mol/L

n=cxV

$n=10^{-2}$ x $2,0.10^{-2}$ mol

$n_f = 2,0.10^{-4}$ mol

$x_f = x_{max}$ so it's a complete reaction

Course

Hcl is a strong acid

It means that its reaction with water is complete $Hcl + h_20 \rightarrow H_3O^+ + cl^-$

So $[H_3O^+] = C$

$CH_3COOH(l)$ is a weak acid

It means that its reaction with water is limited