



Sequence 2: acid-base reactions in aqueous solutions



Fiche de synthèse mobilisée (collection en français) :

- Fiche n°2 : réactions acide-base en solution aqueuse



Sommaire des activités ETLV :

- ACTIVITY 1: Percent dissociation of an acid
- ACTIVITY 2: Influence of dilution on percent dissociation of an acid
- ACTIVITY 3: Influence of pKa on percent dissociation of an acid
- ACTIVITY 4: The contaminated stream

ACTIVITY 1: Percent dissociation of an acid

Objective: understanding percent dissociation

DOCUMENT 1: Percent dissociation

Percent dissociation is symbolized as α (alpha) and represents the ratio of the final concentration of base $[A^-]_f$ (after dissociation) to the initial concentration of the acid $[HA] = C_a$.

Dilute acids dissociate more than concentrated ones. Percent dissociation can be easily calculated if the pH of the solution and the pKa of the acid are known:

$$\alpha = \frac{[A^-]_f}{C_a}$$

■ Acquiring vocabulary:

Find a translation for the following expressions:

English	French
strong acid	
weak acid	
percent dissociation	
dilute acids	
conjugate base	
ratio	

**■ Applying:**

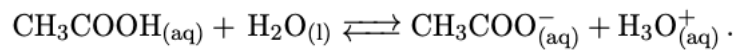
A weak acid, HA , has a pK_a of 4.76. If the solution pH is 3.85, what percentage of the acid is dissociated?

ACTIVITY 2: Influence of dilution on percent dissociation of an acid

Objective: understanding the effect of dilution

DOCUMENT 1: Acetic acid equilibrium

Acetic acid is a weak acid that can dissociate in water as follows:



Its equilibrium constant can be defined as:

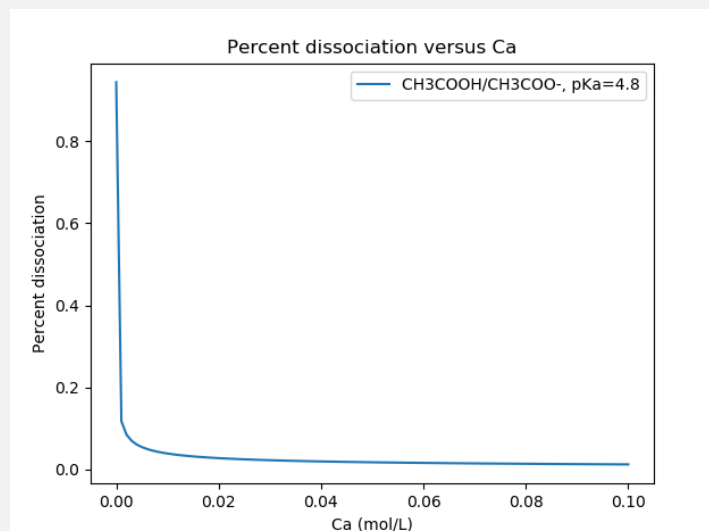
$$K_a = \frac{[\text{CH}_3\text{COO}^-]_{\text{eq}} [\text{H}_3\text{O}^+]_{\text{eq}}}{[\text{CH}_3\text{COOH}]_{\text{eq}} c^\circ} = 10^{-4,8} \simeq 1 \cdot 10^{-5} \ll 1$$

Its percent dissociation constant can thus be defined as:

$$\alpha = \frac{[\text{CH}_3\text{COO}^-]_{\text{eq}}}{C_a} \text{ with } C_a \text{ the initial concentration of acid.}$$

DOCUMENT 2: Influence of dilution

Using Python, one can compute α for different values of C_a . The results are plotted below:





■ **Applying:**

In your opinion, what seems to be the influence of dilution on percent dissociation?

ACTIVITY 3: Influence of pKa on percent dissociation

Objective: understanding the effect of pKa

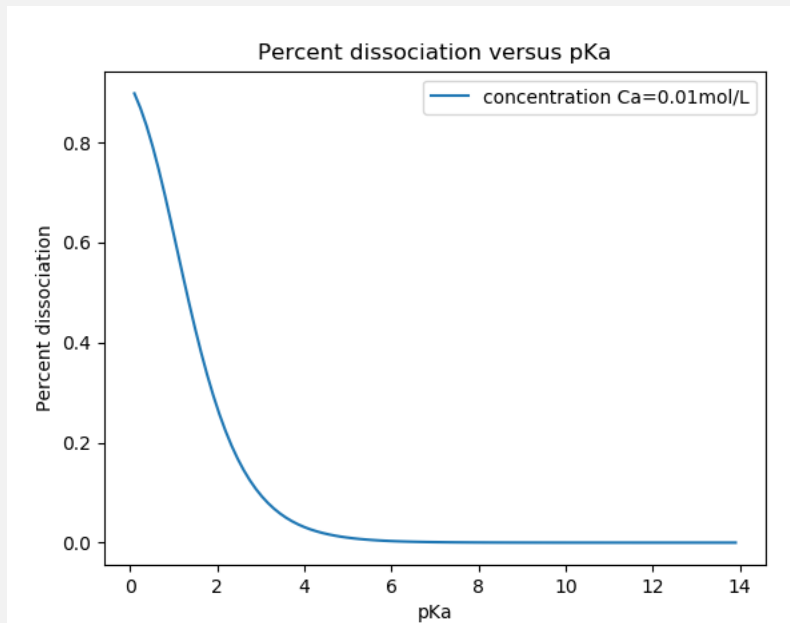
DOCUMENT 1: Acid-base equilibrium

Different acid-base couples are studied. For each acid, the percent dissociation constant can be defined as:

$$\alpha = \frac{[A^-]_{eq}}{C_a} \text{ with } C_a \text{ the initial concentration of acid.}$$

DOCUMENT 2: Influence of pK_a

Using Python, one can compute α for different values of pK_a . The results are plotted below:



■ **Applying:**

In your opinion, what seems to be the influence of pK_a on percent dissociation?



ACTIVITY 4: The contaminated stream

Objective: understanding acid-base titration

This virtual resource is a courtesy of Royal Society of Chemistry: <https://virtual.edu.rsc.org>

We recommend you start with titration level 1

1) Select titration:

Screen experiments

Aspirin

Titration

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2) Select level 1:

Titration screen experiment

Quickstart

Titration level 1

Titration level 2

Titration level 3

Log in

Register

3) Watch the video, then follow the instructions:

Titration screen experiment: The contaminated stream

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Reset

4x zoom

Start

Stop

Sample site B

Trial	1st accurate titration	2nd accurate titration
Final volume (cm ³)		
Initial volume (cm ³)	11.40	
Volume added (cm ³)		
Average volume added (cm ³)		

Click Start to begin running the solution into the flask.
Continue adding the sample until the point at which the solution in the flask becomes colourless. (Click "Stop" at the point at which the colour changes permanently.)

to reach the neutralisation point, and judge when the indicator colour changes.

3:10 3:20



4) Take the comprehension test:

partially dissociates	Hydrochloric acid	alkaline	The pH of water is approximately 7, which means it is
fully dissociates	when dissolved in water.	acidic	
does not dissociate		neutral	
an acidification	When an acid and alkali react to form water and salt it is called	known concentration	A titration experiment can be used to determine the
an indicator		volume	
a neutralisation	reaction.	unknown concentration	of acid using a known concentration of base.
ionisation point	An indicator helps us to see the		
burette reading			
point of neutralisation	during a titration experiment by causing a colour change.		

If you have succeeded, you can follow the instructions until the teacher tells you to stop.

Activity summary

What you must remember:

- **weak acid, strong acid**
- **percent dissociation**

Skills linked to the curriculum:

Compétences	Capacités à maîtriser	Où dans cette séquence ?
APP	Utiliser du vocabulaire spécifique	Activités 1 à 4
	Lire et comprendre des documents scientifiques	Activités 1 à 4
ANA	Mettre en lien des documents pour émettre des hypothèses en réponse à une question scientifique	Activités 2 et 3
COM	S'exprimer à l'écrit en utilisant le vocabulaire adapté	Activités 1 à 3
REA	<ul style="list-style-type: none"> • Utiliser la conservation de la matière pour déterminer le coefficient de dissociation d'un acide faible dans l'eau, connaissant l'état initial et le pH à l'équilibre • Prévoir qualitativement l'effet de la dilution sur le coefficient de dissociation d'un acide faible. 	Activité 1
		Activité 2