

[TP] Modify your sketch of liquid water to add 5 hydronium ions (represented as a circled "+") and 5 hydroxide ions (represented as a circled "–"). Based on your modified sketch (rather than on what you anticipate to be the correct answer), calculate to one significant figure the pH of the water.

17% 1. –1
17% 2. 1
17% 3. 7
17% 4. 10
17% 5. 14
17% 6. ∞

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Response Counter

10

1

Lecture 16 CH102 A1 (MWF 9:05 am)

Monday, February 27, 2017

- Complete: Composition of liquid water
- Weak acids and strong acids
- Getting weak acid K_a values

Next lecture: Continue ch14: Using K_a to get $[H_3O^+]$. Titration: What happens when some OH– is added to an acid?

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Research 101

How to get involved in undergraduate research

Monday, February 27
6pm, SCI/294

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3

Liquid water

Modify your sketch of liquid water to add 5 hydronium ions (represented as a circled "+") and 5 hydroxide ions (represented as a circled "–").

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7

[TP] Modify your sketch of liquid water to add 5 hydronium ions (represented as a circled "+") and 5 hydroxide ions (represented as a circled "–"). Based on your modified sketch (rather than on what you anticipate to be the correct answer), calculate to one significant figure the pH of the water.

17% 1. –1
17% 2. 1
17% 3. 7
17% 4. 10
17% 5. 14
17% 6. ∞

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Response Counter

10

8

Liquid water

Further modify your sketch of liquid water so that it corresponds to pH = 7.

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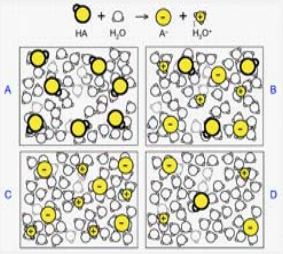
[Quiz] The pH of solution C is approximately ...

17% 1. 1
17% 2. 7
17% 3. 10
17% 4. 14
17% 5. ∞
17% 6. Something else



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Response Counter

10

14

Weak acids and strong acids in aqueous solution

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What is an acid in aqueous solution?

An acid makes $[H_3O^+] > [OH^-]$

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has $pH = x$ and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has $pH = x$ and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

Key idea:

The closer $[H_3O^+]$ is to c_a M, the stronger the acid.

The larger $K_a = [H_3O^+]\,[A^-] / [HA]$, the stronger the acid.

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has $pH = x$ and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$

$K_a = [H_3O^+]\,[A^-] / [HA]$

Strong acids react nearly 100%, and so their $K_a >> 1$

So almost all HA converted to H_3O^+ and A^-

So $[HA] \approx 0$, $[H_3O^+] \approx c_a$ and therefore $pH \approx -\log(c_a)$

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has pH = x and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$

$K_a = [H_3O^+]\,[A^-] / [HA]$

$c_a = 0.05$ M HA has pH = 1.3

$= -\log(c_a) = -\log(-0.05) = 1.3$

So HA is strong

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has pH = x and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$

$K_a = [H_3O^+]\,[A^-] / [HA]$

Weak acids react much less than 100%, and so their $K_a \ll 1$

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has pH = x and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$

$K_a = [H_3O^+]\,[A^-] / [HA]$

Weak acids react much less than 100%, and so their $K_a \ll 1$

So hardly any HA converted to H_3O^+ and A^-

So [HA] ≈ c_a, $[H_3O^+] \ll c_a$ and therefore pH ≫ $-\log(c_a)$

Is an acid strong or weak?

A c_a M aqueous solution of an acid HA has **p**H = x and so $[H_3O^+] = 10^{-x}$.

From this, how can we know whether HA is a strong acid or a weak acid?

$HA(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + A^-(aq)$

$K_a = [H_3O^+]\,[OH^-] / [HA]$

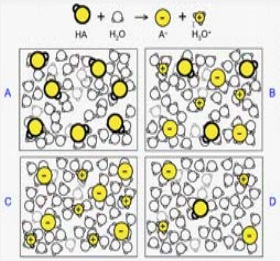
$c_a = 0.1$ M HA has pH = 3 and so ...

$[H_3O^+] = 10^{-3} = 0.001 \ll ca$

So HA is weak

[TP] Which solution in the diagram contains the most dilute acid?

25% 1. A
25% 2. B
25% 3. C
25% 4. D



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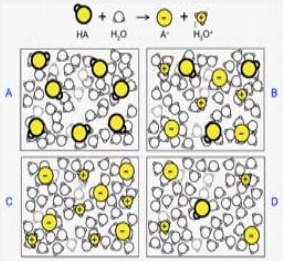
[TP] The reason for your choice in the previous question was that the solution showed the ...

14% 1. highest proportion of A^-
14% 2. lowest proportion of A^-
14% 3. highest $[H_3O^+]$
14% 4. lowest $[H_3O^+]$
14% 5. highest $[HA] + [A^-]$
14% 6. lowest $[HA] + [A^-]$
14% 7. equal $[HA]$ and $[A^-]$



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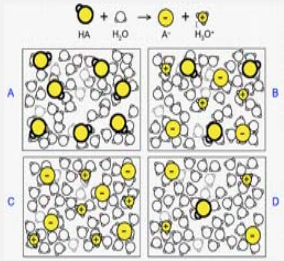
[TP] Which solution in the diagram contains the strongest acid?

25% 1. A
25% 2. B
25% 3. C
25% 4. D



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14% 3. highest $[H_3O^+]$
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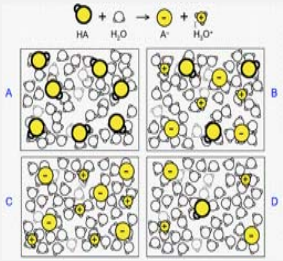
14% 5. highest $[HA] + [A^-]$
14% 6. lowest $[HA] + [A^-]$
14% 7. equal $[HA]$ and $[A^-]$



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