[TP] HCl(*aq*) means ...

17% 1. H^+ ions and Cl^- ions surrounded by waters
17% 2. H_3O^+ ions and Cl^- ions surrounded by waters
17% 3. HCl molecules surrounded by waters
17% 4. (1) and (2) are correct
17% 5. Doesn't exist
17% 6. None of the above

Response Counter 10

Lecture 20 CH101 A1 (MWF 9 am)

Monday, October 24, 2016

- Check: Concentrations after precipitation
- Complete: Acid-base reactions: Competition for H^+

Next lecture: Balancing oxidation-reduction equations; complexation as Lewis acid-base reaction; begin ch7

[Quiz] You are given 150 mL of a 0.20 M aqueous solution of ammonium carbonate and 150 mL of 0.40 M aqueous solution of barium iodide. These solutions are mixed and a precipitate forms. After the precipitation, the solution ...

25% 1. will be positively charged
25% 2. will be electrically neutral
25% 3. will be negatively charged
25% 4. More information needed

A comprehensive example

You are given 150 mL of a 0.20 M aqueous solution of ammonium carbonate and 150 mL of 0.40 M aqueous solution of barium iodide.

These solutions are mixed and a precipitate forms. After the precipitation, the total electrical charge due to the ions remaining in solution is 0.

	Moles of ions	Moles of charge
$NH_4^+(aq)$	0.060	+0.060
$I^-(aq)$	0.120	−0.120
$Ba^{2+}(aq)$	0.030	+0.060
Total		0

[TP] In pure water at 25 ˚C, there is only a tiny, tiny amount of self-ionization, $\sim 10^{-7}$ mol/L. In pure water at 25 ˚C, how many water molecules are there for every OH^- ion?

14% 1. 1
14% 2. 10
14% 3. 100
14% 4. 10,000
14% 5. 1,000,000
14% 6. 10,000,000
14% 7. More than 10,000,000

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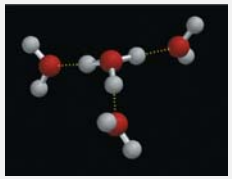
Water self-ionizes, but only a very little

$$HO{:}H(aq) + {:}OH_2(l) \leftrightarrows H{:}OH_2^+(aq) + HO{:}^-(aq)$$

In pure water at 25 ˚C, there is only a tiny, tiny amount of self-ionization, $\sim 10^{-7}$ mol/L.

$H{:}OH_2^+(aq)$, usually written $H_3O^+(aq)$, is typically hydrogen bonded to several other water molecules, with the partners continually exchanging with other water molecules.



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Acid-base reactions: Competition for H^+

Brønsted-Lowry model:

The H^+ donor is called an acid

$$CH_3C(O)O{:}H(aq) + {:}OH_2(l) \rightleftarrows H{:}OH_2^+(aq) + CH_3C(O)O{:}^-(aq)$$

The H^+ acceptor is called a base

$$HO{:}H(aq) + {:}NH_3(aq) \rightleftarrows H{:}NH_3^+(aq) + HO{:}^-(aq)$$

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Practice: Acids and bases

$$HCOOH(aq) + OH^-(aq) \rightleftarrows HCOO^-(aq) + H_2O(l)$$

$HCOOH(aq)$ donates protons, so it is the acid
$OH^-(aq)$ accepts protons, so it is the base

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Practice: Acids and bases

$NH_3(aq) + H_2CO_3(aq) \rightleftarrows NH_4^+(aq) + HCO_3^-(aq)$

$NH_3(aq)$ accepts protons, so it is the base
$H_2CO_3(aq)$ donates protons, so it is the acid

Practice : Acids and bases

$H_2C_4H_4O_6(aq) + HCO_3^-(aq) \rightleftarrows HC_4H_4O_6^-(aq) + H_2CO_3(aq)$

$H_2C_4H_4O_6(aq)$ donates protons, so it is the acid
$HCO_3^-(aq)$ accepts protons, so it is the base

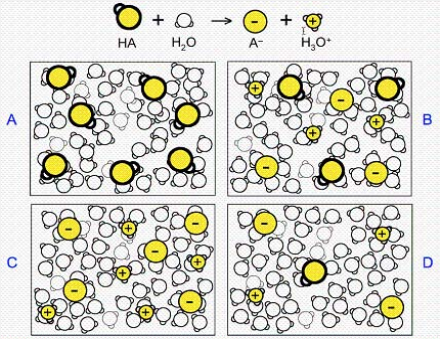
Practice: Acids and bases

$CH_3NH_2(aq) + H_3O^+(aq) \rightleftarrows CH_3NH_3^+(aq) + H_2O(l)$

$CH_3NH_2(aq)$ accepts protons, so it is the base
$H_3O^+(aq)$ donates protons, so it is the acid

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

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



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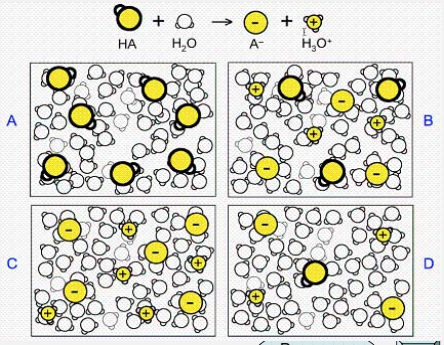

Response Counter 10

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Response Counter 10

Base strength

Weak bases are weak electrolytes: They react only to a small extent with water

$$HO{:}H(aq) + {:}NH_2CH_2CH_3(aq) \rightleftarrows H{:}NH_2CH_2CH_3^+(aq) + HO{:}^-(aq)$$

Only a little reaction (< 100 % theoretical yield)

Base strength

Strong bases are strong electrolytes: They react nearly completely with water

$$Na{:}OH(s) \rightarrow Na^+(aq) + HO{:}^-(aq)$$

Nearly complete reaction (~ 100 % theoretical yield)

$HO{:}^-(aq)$ is a strong proton acceptor

Note that NaOH(*s*) is a special case: There is no competition for H^+, only hydration of OH^-.