

Announcements – Lecture XIX – Thursday, Nov 14th

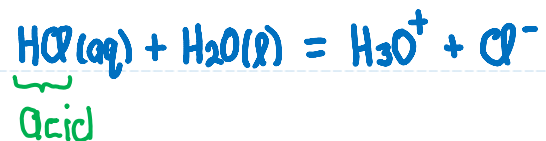
1. **Lab 5 – Saturday, November 16th, 1:00-4:00 pm – ISB 155/160 A-E**
Lab Owl IV– Deadline – Saturday, November 16th, 11:59 pm

2.  *iClicker:*
Choose any letter: A-E

8.3 What Are Conjugate Acid-Base Pairs?

ARRHENIUS:

Acid: Produces H_3O^+ in water.

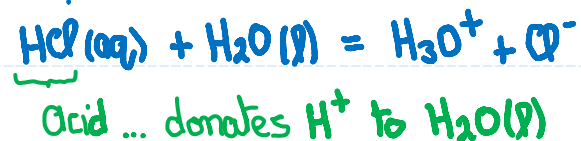


Base: Produces OH^- in water.

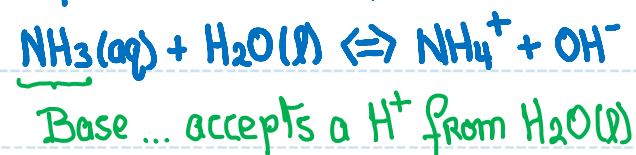


BRONSTED LOWRY

Acid: A proton (H^+) donor ...

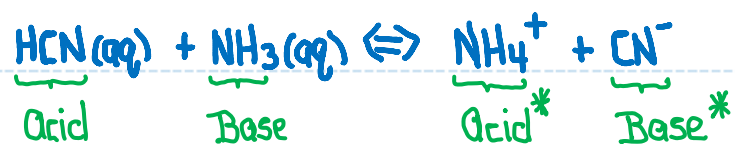
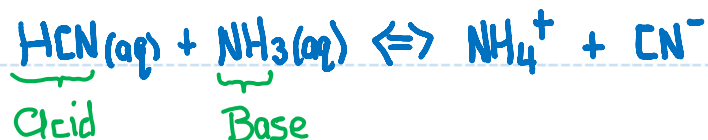


Base: A proton (H^+) acceptor



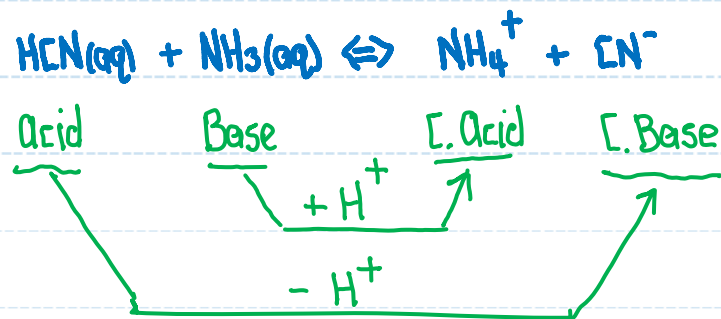
? ... Notice anything about $\text{H}_2\text{O(l)}$ in the two examples given above??

8.3 What Are Conjugate Acid-Base Pairs?



Acid* - Conjugate acid
Base* - Conjugate base

HCN/CN⁻ ... Acid/Conjugate base pair
NH₃/NH₄⁺ ... Base/Conjugate acid pair



Acid - H⁺ = its conjugate base
Base + H⁺ = its conjugate acid

Cations behaving as acids?
Anions behaving as bases?

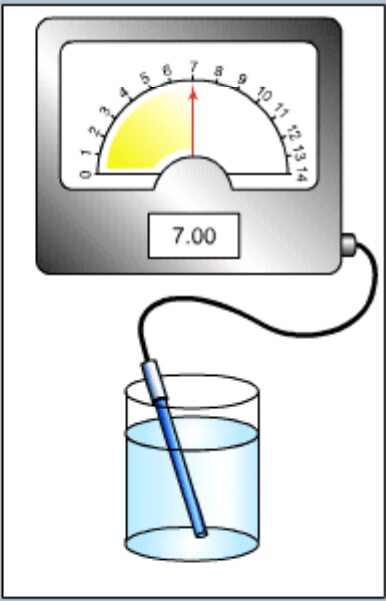
8.3 What Are Conjugate Acid–Base Pairs? – Consequences

Hydrolysis See class web site Description

Cation	Anion
<input type="radio"/> Na ⁺	<input type="radio"/> Cl ⁻ 7.0
<input type="radio"/> NH ₄ ⁺	<input type="radio"/> F ⁻ 7.6
<input type="radio"/> C ₅ H ₅ NH ⁺	<input type="radio"/> CN ⁻ 10.7
	<input type="radio"/> NO ₂ ⁻ 7.7
	<input type="radio"/> ClO ⁻ 9.7

Concentration
0.01 M

Salt: NaCl
pH = 7.00



Base

Conjugate acid



... strong acid



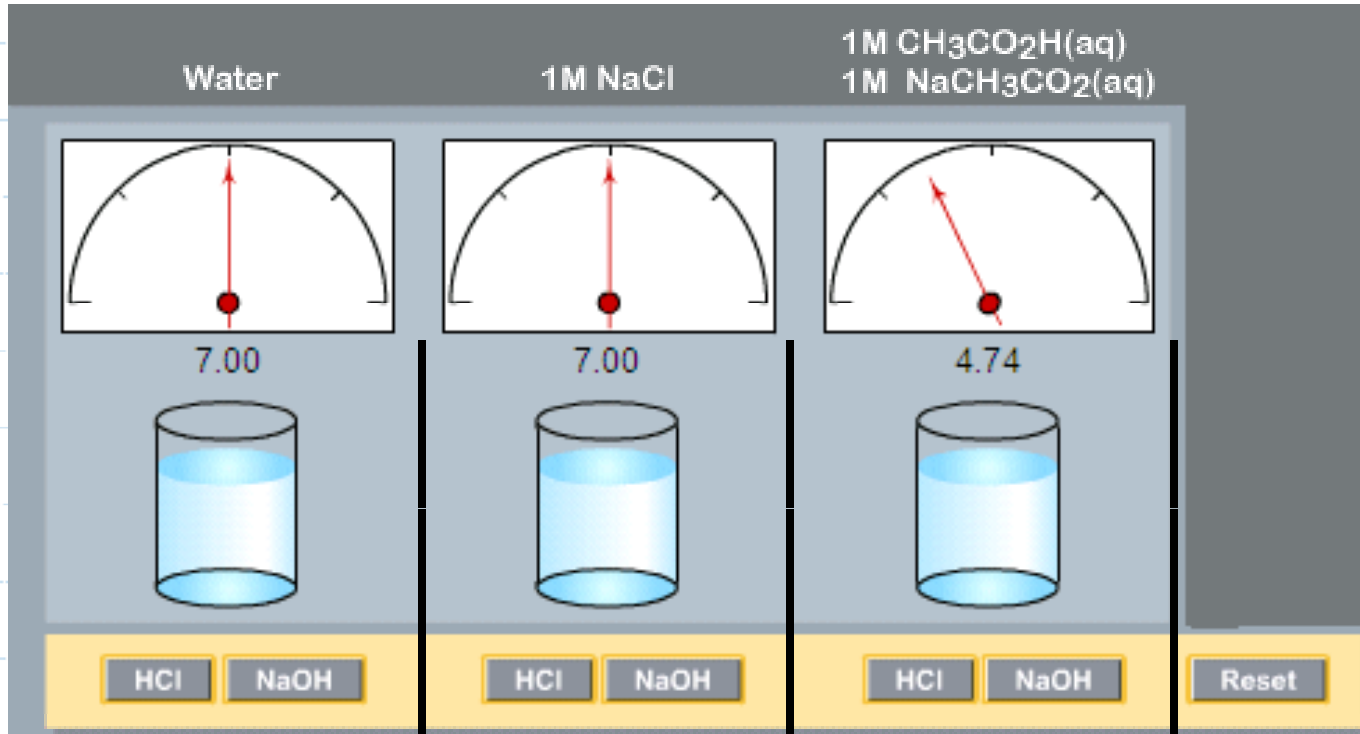
} all weak acids



pH Up ... Sodium carbonate ... Washing Soda



8.10 What Are Buffers?



pH	7.00	7.00	4.74	INITIAL
pH	1.04	1.04	4.65	Add H_3O^+
pH	12.96	12.96	4.83	Add OH^-

Large pH change

Small pH change

CH_3CO_2H ... acid

$CH_3CO_2^-$... base ... Conjugate base of CH_3CO_2H !



8.10 What Are Buffers? – How Do They Resist Drastic pH Changes

Addition of Strong Acid – H_3O^+

$1\text{M } \underline{\text{CH}_3\text{CO}_2\text{H}} / 1\text{M } \underline{\text{CH}_3\text{CO}_2^-}$
acid conjugate base

H_3O^+ \swarrow SA + WB = 100%



OVERALL CHANGES

$[\text{CH}_3\text{CO}_2^-]$: \downarrow ... Reacted with the added H_3O^+ .

$[\text{CH}_3\text{CO}_2\text{H}]$: \uparrow ... A product of the reaction that removed the H_3O^+ .

$[\text{H}_3\text{O}^+]$: \uparrow ... not by much ... a result of $[\text{CH}_3\text{CO}_2\text{H}] \uparrow$.

pH : \downarrow ... not by much.

8.10 What Are Buffers? – How Do They Resist Drastic pH Changes

Addition of Strong Base – OH⁻

1M CH₃CO₂H / 1M CH₃CO₂⁻

Acid

Conjugate base

↑
↓
OH⁻

WA + SB = 100%



OVERALL CHANGES:

[CH₃CO₂H] : ↓ ... Reacted with the added OH⁻

[CH₃CO₂⁻] : ↑ ... A product of the reaction that removed the OH⁻

[OH⁻] : ↑ ... not by much ... a result of [CH₃CO₂⁻]↑ ... a base

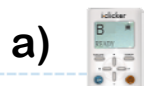
pH : ↑ ... not by much

8.10 What Are Buffers? – How Do They Resist Drastic pH Changes

A buffer solution made from HF and KF has a pH = 2.84.

Addition of OH⁻ will cause –

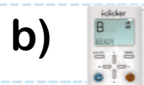
1. Increase significantly
2. Increase slightly
3. Decrease significantly
4. Decrease slightly
5. Increase
6. Decrease



pH ?

2

Adding base ... solution will become MORE basic



pOH ?

4

[OH⁻] ↑ ... pOH = -log₁₀ [OH⁻] will ↓

