

Acids and Bases

Electrolytes

Strong

Weak

Non-electrolyte

Acids and Bases are Electrolytes

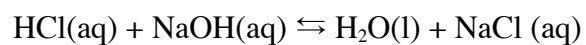
Acids

Bases

Arrhenius Model

Acid

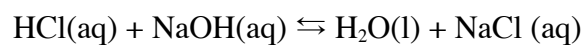
Base



Bronsted-Lowry Theory

Acid

Base



Lewis Acid/Base Theory

Acid

Base

Conjugate Acid and Bases

Acid

Example

Base

Example

Write the dissociation equations when the following electrolytes react with water:

1) HNO_3 2) $\text{HC}_2\text{H}_3\text{O}_2$ 3) HCN 4) HOCl 5) CH_3NH_2 6) F^- 7) NH_3 8) HCl 9) HBr 10) HI

Ka and Kb

What about Kw

Indicators:

Strong Acid

Acid Strength

Polyprotic Acid

reactions:

Amphoteric/Amphiprotic

A mathematical treatment of acids and bases

How do hydrogen and hydroxide relate to each other in a solution? We base everything on K_w .

Acids

Bases

Some Background from math class

Logarithms

pH is a measure of a substances acidity!

Are pH and pOH related to each other?

How about K_a and K_b ?

Why is the pH of pure water 7?

A square roadmap

Can you do significant digits with logs?

What is the pH of some 0.10 M HCl?

pH	pOH	H ⁺	OH ⁻	Acidic or Basic
10				
		1.00×10^{-5}		
			1.00	
		2.00×10^{-9}		
	7.65			
1.23				
		10.0		

Weak Acids

1) What is the pH of a 0.20 M HCN solution? The K_a for HCN is 6.5×10^{-10} .

2) The K_a for acetic acid is 1.75×10^{-5} . What is pH of a 0.10M solution of acetic acid in water?

3) What is the pH of some was 0.50M formic acid (HCOOH)? The K_a is 1.772×10^{-4} .

4) What is the pH of 0.25M HOCl if the K_a is 3.5×10^{-8} ?

5) What is the pH of a 0.10M HF solution. K_a is 6.5×10^{-4} ?

Weak Bases

We have the same basic problems here with pH exchanged for pOH!

6) Dimethyl amine is a weak base whose formula is $(\text{CH}_3)_2\text{NH}$. K_b for it is 5.9×10^{-4} . What is the pH of some 0.750 M dimethyl amine?

Salts

When HCl dissociates in water the two remaining ions have no affinity to react with water. What if the remaining ions DO react with water? What would determine this?

NaF

NH₄Cl**Acid Dissociation Constants**

HClO ₄	large	H ₂ CO ₃	4.5×10^{-7}
HBr	large	NH ₄ ⁺	6.3×10^{-10}
HF	6.5×10^{-4}	HCN	6.3×10^{-10}
HC ₂ H ₃ O ₂	1.8×10^{-5}	H ₂ O	10^{-14}

Using the above hierarchy of acid/base strength determine if solutions of the following salts are acidic, basic, or neutral.

	Parent Acid/Strength	Parent Base/ Strength	Salt
KCl			
KF			
NH ₄ Br			
KClO ₄			
KCN			
NH ₄ CN			
KC ₂ H ₃ O ₂			
NH ₄ C ₂ H ₃ O ₂			
NH ₄ F			

7) What is the pH of some LiCN in water if it is 0.10 M and K_a for HCN is 6.3×10^{-10} ?

8) What is the pH of some 0.250 M NH_4Cl ? The K_b for ammonia is 1.8×10^{-5} ?

9) What is the pH of a NaF solution that is 0.10M? K_a is 6.5×10^{-4}

10) What is the pH of a 0.10 M solution of $\text{KC}_2\text{H}_3\text{O}_2$?

Polyprotic Acids

Write the two dissociations for H_2SO_4

K_a Values

	H₂SO₄	H₂CO₃	H₃PO₄
K _{a1}	Large	4.3×10^{-7}	7.5×10^{-3}
K _{a2}	1.2×10^{-2}	5.6×10^{-11}	6.2×10^{-8}
K _{a3}	none	none	4.8×10^{-13}

Size Matters

What is the pH of some 0.10 M H_2CO_3 ?

First Dissociation

Second Dissociation

What is the pH of some 0.10 M H_2SO_4 ?

First Dissociation

Second Dissociation

Temperature dependence of K_w Temperature K_w

0°C	1.14×10^{-14}
25°C	1.00×10^{-14}
35°C	2.09×10^{-14}
40°C	2.92×10^{-14}
50°C	5.47×10^{-14}

Is the autoionization of water exothermic or endothermic?

What is the pH of a neutral solution at 50°C?

Determining the strengths of Acids and Bases

Halogen Acids

HF

HCl

HBr

HI

What about in an oxyacid?

HCl

HClO

HClO₂HClO₃HClO₄