

Name: _____
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CHEMISTRY 12
ACID BASES UNIT
Lesson #6

"STRONG AND WEAK" ACIDS AND BASES

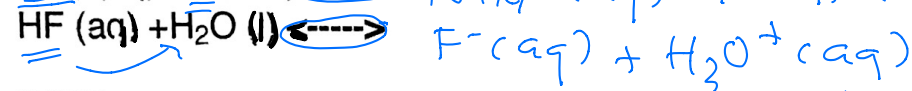
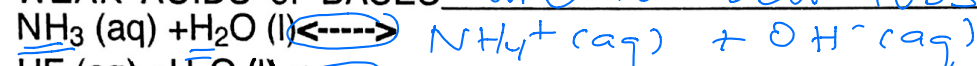
(NO EQUILIBRIUM)

STRONG ACIDS or BASES: are ionized 100% in solution



(EQUILIBRIUMS!)

WEAK ACIDS or BASES are ionized less than 100% in



IMPT:

1. EQUILIBRIUMS involve ONLY weak acids/bases, NOT STRONG!!!!

2. IN PRACTICE weak acids and bases are ionized < 50%.

3. IN CHEMISTRY 12 it is important to get the following terms straight:

STRONG + WEAK- refer to the degree of ionization.

DILUTE + CONCENTRATED- refer to the Molarity of a solution
(mol/L)

NOW LETS EXAMINE THE:

"Relative Strengths of Bronsted-Lowry Acids and Bases" Table.

STRONG ACIDS:

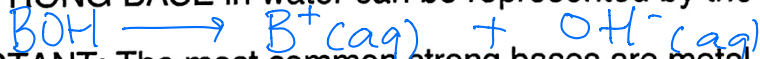
Notice the ONE-WAY ARROWS, that is because STRONG acids do NOT reach equilibrium!!!

Any STRONG ACID in water can be represented by the equation:



STRONG BASES:

Any STRONG BASE in water can be represented by the equation:



IMPORTANT: The most common strong bases are metal hydroxides (although they do not directly get mentioned on this table) you should be familiar with the following:

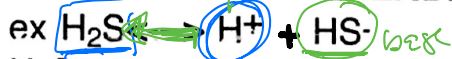


WEAK ACIDS: appear on the LEFT side of the table. OH- and NH3 NEVER ACT as ACIDS in aqueous solutions!

WEAK BASES: appear on the RIGHT side of the table, the top six species (ClO_4^- to HSO_4^-) NEVER act as BASES in aqueous solutions!

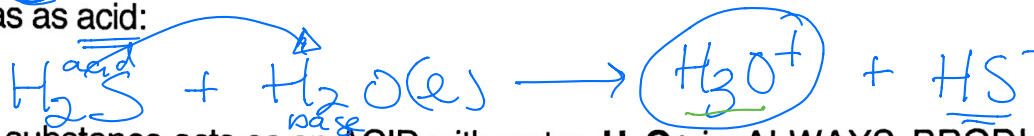
A SPECIAL NOTE READING THE TABLE:

water is absent



H_2S acting as an acid:

L-R



When a substance acts as an ACID with water, H_3O^+ is ALWAYS PRODUCED!!!

HS^- acting as a base:

R-L



When a substance acts as a base with water, OH^- is ALWAYS PRODUCED!!!

OTHER RELATIONSHIPS FOUND IN THE TABLE:

1. The HIGHER a species is on the left side = the stronger the ACID
2. The LOWER the species is on the right side = the stronger the BASE
3. The STRONGER the ACID, the weaker it's CONJUGATE BASE (*VICE VERSA*)
4. AMPHIPROTIC species appear on BOTH SIDES of the table!



"THE LEVELLING EFFECT of WATER"

WATER "levels out" the strength of all STRONG ACIDS to the same strength, therefore H_3O^+ is the STRONGEST ACID that exists in AQUEOUS SOLUTIONS!!!



Water also "levels out" the strength of all STRONG BASES to the same strength, therefore OH^- is the STRONGEST BASE that exists in AQUEOUS SOLUTIONS!!!!



DEFINITION of THE LEVELLING EFFECT:

All STRONG ACIDS are 100% IONIZED in aqueous solutions and are equivalent to solutions of H_3O^+ , while all STRONG BASES are 100% IONIZED in aqueous solutions and are equivalent to solutions of OH^- !

SEATWORK/HOMEWORK:

What sort of an electrical current would a STRONG ACID or BASE solution generate compared to a WEAK ACID or BASE solution? Explain Why

Exercises 21-27 pgs 125-126

PLO's: K1-K7

RELATIVE STRENGTHS OF BRØNSTED-LOWRY ACIDS AND BASES

in aqueous solution at room temperature.

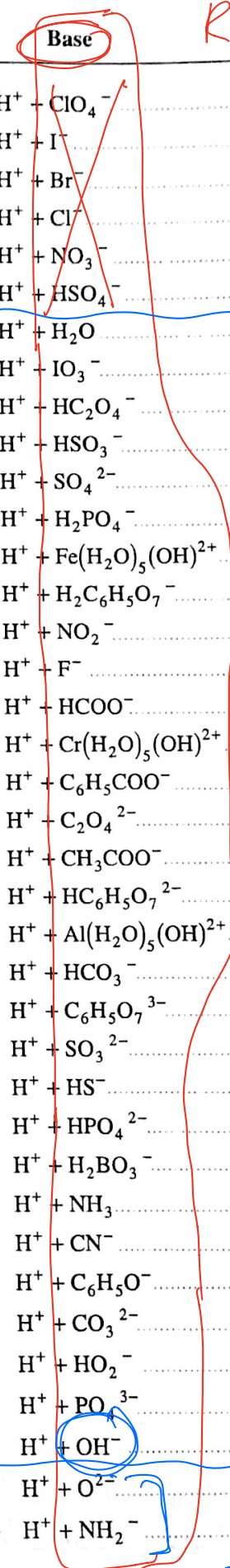
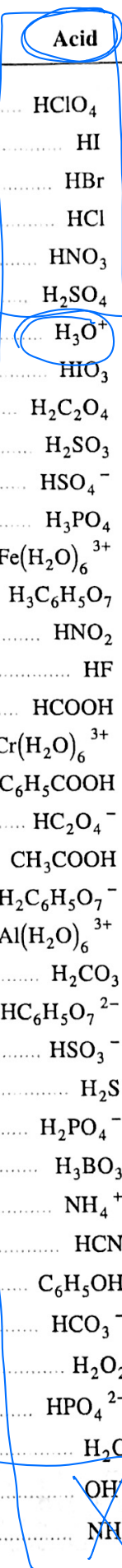
Name of Acid	L	Acid	Base	R	K_a
Perchloric		$\text{HClO}_4 \rightarrow \text{H}^+ + \text{ClO}_4^-$	ClO_4^-		very large
Hydriodic		$\text{HI} \rightarrow \text{H}^+ + \text{I}^-$	I^-		very large
Hydrobromic		$\text{HBr} \rightarrow \text{H}^+ + \text{Br}^-$	Br^-		very large
Hydrochloric		$\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$	Cl^-		very large
Nitric		$\text{HNO}_3 \rightarrow \text{H}^+ + \text{NO}_3^-$	NO_3^-		very large
Sulphuric		$\text{H}_2\text{SO}_4 \rightarrow \text{H}^+ + \text{HSO}_4^-$	HSO_4^-		very large
Hydronium Ion		$\text{H}_3\text{O}^+ \rightleftharpoons \text{H}^+ + \text{H}_2\text{O}$	H_2O		1.0
Iodic		$\text{HIO}_3 \rightleftharpoons \text{H}^+ + \text{IO}_3^-$	IO_3^-		1.7×10^{-1}
Oxalic		$\text{H}_2\text{C}_2\text{O}_4 \rightleftharpoons \text{H}^+ + \text{HC}_2\text{O}_4^-$	HC_2O_4^-		5.9×10^{-2}
Sulphurous ($\text{SO}_2 + \text{H}_2\text{O}$)		$\text{H}_2\text{SO}_3 \rightleftharpoons \text{H}^+ + \text{HSO}_3^-$	HSO_3^-		1.5×10^{-2}
Hydrogen sulphate ion		$\text{HSO}_4^- \rightleftharpoons \text{H}^+ + \text{SO}_4^{2-}$	SO_4^{2-}		1.2×10^{-2}
Phosphoric		$\text{H}_3\text{PO}_4 \rightleftharpoons \text{H}^+ + \text{H}_2\text{PO}_4^-$	H_2PO_4^-		7.5×10^{-3}
Hexaaquoiron ion, iron(III) ion		$\text{Fe}(\text{H}_2\text{O})_6^{3+} \rightleftharpoons \text{H}^+ + \text{Fe}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$\text{Fe}(\text{H}_2\text{O})_5(\text{OH})^{2+}$		6.0×10^{-3}
Citric		$\text{H}_3\text{C}_6\text{H}_5\text{O}_7 \rightleftharpoons \text{H}^+ + \text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$	$\text{H}_2\text{C}_6\text{H}_5\text{O}_7^-$		7.1×10^{-4}
Nitrous		$\text{HNO}_2 \rightleftharpoons \text{H}^+ + \text{NO}_2^-$	NO_2^-		4.6×10^{-4}
Hydrofluoric		$\text{HF} \rightleftharpoons \text{H}^+ + \text{F}^-$	F^-		3.5×10^{-4}
Methanoic, formic		$\text{HCOOH} \rightleftharpoons \text{H}^+ + \text{HCOO}^-$	HCOO^-		1.8×10^{-4}
Hexaaquo chromium ion, chromium(III) ion		$\text{Cr}(\text{H}_2\text{O})_6^{3+} \rightleftharpoons \text{H}^+ + \text{Cr}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$\text{Cr}(\text{H}_2\text{O})_5(\text{OH})^{2+}$		1.5×10^{-4}
Benzoic		$\text{C}_6\text{H}_5\text{COOH} \rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{COO}^-$	$\text{C}_6\text{H}_5\text{COO}^-$		6.5×10^{-5}
Hydrogen oxalate ion		$\text{HC}_2\text{O}_4^- \rightleftharpoons \text{H}^+ + \text{C}_2\text{O}_4^{2-}$	$\text{C}_2\text{O}_4^{2-}$		6.4×10^{-5}
Ethanoic, acetic		$\text{CH}_3\text{COOH} \rightleftharpoons \text{H}^+ + \text{CH}_3\text{COO}^-$	CH_3COO^-		1.8×10^{-5}
Dihydrogen citrate ion		$\text{H}_2\text{C}_6\text{H}_5\text{O}_7^- \rightleftharpoons \text{H}^+ + \text{HC}_6\text{H}_5\text{O}_7^{2-}$	$\text{HC}_6\text{H}_5\text{O}_7^{2-}$		1.7×10^{-5}
Hexaaquoaluminum ion, aluminum ion		$\text{Al}(\text{H}_2\text{O})_6^{3+} \rightleftharpoons \text{H}^+ + \text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}$	$\text{Al}(\text{H}_2\text{O})_5(\text{OH})^{2+}$		1.4×10^{-5}
Carbonic ($\text{CO}_2 + \text{H}_2\text{O}$)		$\text{H}_2\text{CO}_3 \rightleftharpoons \text{H}^+ + \text{HCO}_3^-$	HCO_3^-		4.3×10^{-7}
Monohydrogen citrate ion		$\text{HC}_6\text{H}_5\text{O}_7^{2-} \rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}_7^{3-}$	$\text{C}_6\text{H}_5\text{O}_7^{3-}$		4.1×10^{-7}
Hydrogen sulphite ion		$\text{HSO}_3^- \rightleftharpoons \text{H}^+ + \text{SO}_3^{2-}$	SO_3^{2-}		1.0×10^{-7}
Hydrogen sulphide		$\text{H}_2\text{S} \rightleftharpoons \text{H}^+ + \text{HS}^-$	HS^-		9.1×10^{-8}
Dihydrogen phosphate ion		$\text{H}_2\text{PO}_4^- \rightleftharpoons \text{H}^+ + \text{HPO}_4^{2-}$	HPO_4^{2-}		6.2×10^{-8}
Boric		$\text{H}_3\text{BO}_3 \rightleftharpoons \text{H}^+ + \text{H}_2\text{BO}_3^-$	H_2BO_3^-		7.3×10^{-10}
Ammonium ion		$\text{NH}_4^+ \rightleftharpoons \text{H}^+ + \text{NH}_3$	NH_3		5.6×10^{-10}
Hydrocyanic		$\text{HCN} \rightleftharpoons \text{H}^+ + \text{CN}^-$	CN^-		4.9×10^{-10}
Phenol		$\text{C}_6\text{H}_5\text{OH} \rightleftharpoons \text{H}^+ + \text{C}_6\text{H}_5\text{O}^-$	$\text{C}_6\text{H}_5\text{O}^-$		1.3×10^{-10}
Hydrogen carbonate ion		$\text{HCO}_3^- \rightleftharpoons \text{H}^+ + \text{CO}_3^{2-}$	CO_3^{2-}		5.6×10^{-11}
Hydrogen peroxide		$\text{H}_2\text{O}_2 \rightleftharpoons \text{H}^+ + \text{HO}_2^-$	HO_2^-		2.4×10^{-12}
Monohydrogen phosphate ion		$\text{HPO}_4^{2-} \rightleftharpoons \text{H}^+ + \text{PO}_4^{3-}$	PO_4^{3-}		2.2×10^{-13}
Water		$\text{H}_2\text{O} \rightleftharpoons \text{H}^+ + \text{OH}^-$	OH^-		1.0×10^{-14}
Hydroxide ion		$\text{OH}^- \leftarrow \text{H}^+ + \text{O}^{2-}$	O^{2-}		very small
Ammonia		$\text{NH}_3 \leftarrow \text{H}^+ + \text{NH}_2^-$	NH_2^-		very small

STRONG ACIDS

STRONG

STRENGTH OF ACID

STRENGTH OF BASE



BASES