AP CHEMISTRY

TOPIC 7: ACIDS & BASES, PART C — EXAMPLES — Day 77:

- Bases
- Weak bases

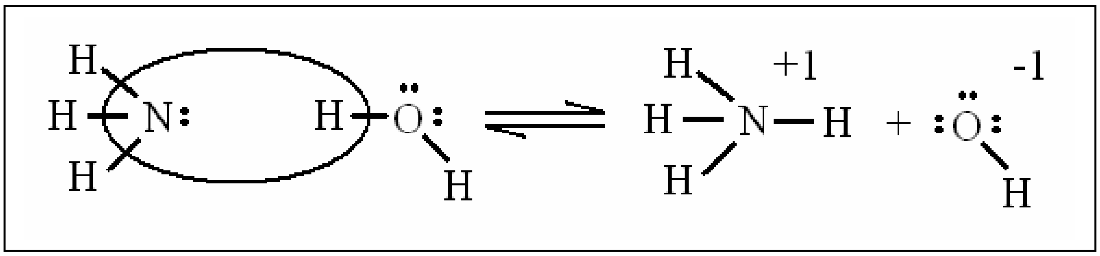
Strong Bases, same as strong acids, dissociates to 100%. The K_b > 1

ALL hydroxides of the Group 1A elements (LiOH, NaOH, KOH, RbOH, CsOH) are strong bases. Also, $Ba(OH)_2$, and $Sr(OH)_2$ are strong bases.

Since many of the alkaline earth metals are not very soluble and used only when the solubility factor is not important (we will discuss the "limits of solubility" later .)

Many types of proton acceptors (bases) do not contain the hydroxide ion. ***<u>HUGE AP CONCEPT</u>***

However, when these proton acceptors dissolve in water, they increase the concentration of hydroxide ion to yield a basic solution (see below for an example of ammonia acting as a base.) Most of these types of bases have a lone pair of electrons on a central atom (nitrogen atom).



The generic equation for these reactions are:

$B_{(aq)}$	+	$H_2O_{(l)}$	$\leftrightarrow$	$BH^{+1}_{(aq)}$	+	$OH^{-1}_{(aq)}$
base		acid		CA		CB

The equilibrium expression for this general reaction is:

$$K_b = \frac{\left[BH^{+1} \right]\left[OH^{-1} \right]}{\left[B \right]}$$

Weak Bases: Same idea as weak acids – ICE chart…and K_b values that are "small" (less than one)

Example: Calculate the pH for a 15.0 *M* solution of NH_3 (K_b = 1.8 x 10^{-5}).

Turn the page to see solution to the question …

Answers: ***WEAK BASE …***

	$[NH_3]$	+	$[H_2O]$	$\rightleftharpoons$	$[NH_4^{+1}]$	+	$[OH^{-1}]$
I	15.0 *M*		-		0		0
C	- *x*		-		+ *x*		+ *x*
E	15.0 *M* - *x*		-		*x*		*x*

$$K_b = 1.8 \times 10^{-5} = \frac{\left[NH_4^{+1} \right]\left[OH^{-1} \right]}{\left[NH_3 \right]} = \frac{(x)(x)}{15.0 - x} = \frac{x^2}{15.0}$$

$$x^2 = \left(1.8 \times 10^{-5}\right)(15.0)$$

$$x = \sqrt{2.70 \times 10^{-4}} = 0.0164 \ M$$

pOH = - log (0.0164) = 1.78

pH = 14 – pOH = 14 - 1.78 = 12.22

OR

pH =14 – (- log (1.64 x 10 $^{-2}$ ***)) = 12.22***

Turn the page to see solution to the question next question …

Example: Calculate the pH of a 1.0 *M* solution of methylamine. $K_b = 4.38 \times 10^{-4}$

Answers: ***WEAK BASE …***

	[CH_3NH_2]	+	[H_2O]	$\rightleftharpoons$	[$CH_3NH_3^{+1}$]	+	[OH^{-1}]
I	1.0 *M*		-		0		0
C	**-** x		-		+ x		+ x
E	1.0 *M* - x		-		x		x

$$K_b = 4.38 \times 10^{-4} = \frac{\left[CH_3NH_3^{+1} \right]\left[OH^{-1} \right]}{\left[CH_3NH_2 \right]} = \frac{(x)(x)}{1.0 - x} = \frac{x^2}{1.0} = 4.38 \times 10^{-4}$$

$$x^2 = \left(4.38 \times 10^{-4}\right)(1.0)$$

$$x = \sqrt{4.38 \times 10^{-4}} = 0.0209 \ M$$

pOH = - log (0.0209) = 1.68

pH = 14 – pOH = 14 - 1.68 = 12.32

OR

pH =14 – (- log (0.0209)) = 12.32