general

$B + H_2O \rightleftharpoons HB^+ + OH^-$

$K_b = \frac{[HB^+][OH^-]}{[B]}$ $\quad pOH = 14 - pH$ $\quad [OH^-] = 10^{-pOH}$

the weaker the base, the stronger the conjugate acid

conjugate pair $K_a \cdot K_b = 10^{-14}$ (K_w)

HF $K_a = 3.5 \times 10^{-4}$

$F^- \; K_b = \frac{10^{-14}}{K_a} = \frac{10^{-14}}{3.5 \times 10^{-4}} = 2.9 \times 10^{-11}$

Morphine $C_{17}H_{19}NO_3$ is an alkaloid (weak base)

If a 0.0075 M solution of morphine has a pH of 10.1, what is its K_b?

$Mor + H_2O \rightleftharpoons HMor^+ + OH^-$ $\quad pOH = 14 - 10.1 = 3.9$

	0.0075	0	0
-1.3×10^{-4}		1.3×10^{-4}	1.3×10^{-4}
	0.0074		

$[OH^-] = 10^{-3.9} = 1.3 \times 10^{-4}$

$K_b = \frac{(1.3 \times 10^{-4})^2}{0.0074} = 2.3 \times 10^{-6}$

K_a $HMor^+$? $\quad \frac{10^{-14}}{2.3 \times 10^{-6}} = 4.3 \times 10^{-9}$

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0.0075	0	0	$[OH^-] = 10^{-3.9}$
-1.3×10^{-4}			$= 1.3 \times 10^{-4}$
0.0074	1.3×10^{-4}	1.3×10^{-4}	

$K_b = \frac{(1.3 \times 10^{-4})^2}{0.0074} = 2.3 \times 10^{-6}$

K_a $HMor^+$? $\frac{10^{-14}}{2.3 \times 10^{-6}} = 4.3 \times 10^{-9}$

A weak base similar to morphine has a $K_b = 5.5 \times 10^{-5}$.
What is the $[OH^-]$, pOH, pH of a 0.15M solution of this base?

$$B + H_2O \rightleftharpoons HB^+ + OH^-$$

0.15	0	0
$-x$	$+x$	$+x$
$0.15 - x$	x	x
≈ 0.15		

$$K_b = 5.5 \times 10^{-5} = \frac{x^2}{0.15}$$

$x = 0.0029M = [OH^-]$

$pOH = -\log(0.0029) = 2.54$

$pH = 14 - 2.54 = 11.46$