

(16.50) Ca(OH)_2 $\text{pH} = 12.05$

5.6×10^{-3} x	5.6×10^{-3} x	1.12×10^{-2} $\frac{2x}{2x}$
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$\text{Ca(OH)}_2 \rightarrow \text{Ca}^{+2} + 2\text{OH}^-$

MOLE RATIO
 $[\text{OH}^-] = ?$

$\text{pH} = 12.05$
 $\text{pOH} = 1.95$ $\text{pH} + \text{pOH} = 14$

$\text{pOH} = -\log[\text{OH}^-]$
 $-1.95 = \log[\text{OH}^-]$
 $[\text{OH}^-] = 1.12 \times 10^{-2}$

Mar 17-7:39 AM

(16.51) $\text{HA} \rightarrow \text{H}^+ + \text{A}^-$ $\text{pH} = 2.68$

I	0.085M	x	x
Δ	-x	+x	+x
E	$0.085 - x$ $0.085 - 2.9 \times 10^{-3}$	x 2.09×10^{-3}	x 2.09×10^{-3}

$\text{pH} = -\log(\text{H}^+)$
 $-2.68 = \log(\text{H}^+)$
 $[\text{H}^+] = 2.09 \times 10^{-3} \text{ M}$

$K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]} = \frac{(2.09 \times 10^{-3})^2}{0.085 - 2.09 \times 10^{-3}} = 5.3 \times 10^{-5} = K_a$

Mar 17-8:17 AM

(16.51)

Whole $HA \rightarrow H^+ + A^-$ $K_a = 3.3 \times 10^{-4}$
 $P_H = ?$
 $P_H = -\log[H^+]$

Initial	2.22 × 10 ⁻²	0	0
Change	-x	+x	+x
Equilibrium	2.22 × 10 ⁻² - x	x	x

Part

(100%)

lg ASA	100g ASA	0.0222 M
0.25g	10g ASA	2.22 × 10 ⁻² M ASA

$K_a = \frac{[H^+][A^-]}{[HA]} = \frac{(x)(x)}{(2.22 \times 10^{-2} - x)} = 3.3 \times 10^{-4}$

$x^2 + 3.3 \times 10^{-4}x - 7.325 \times 10^{-6} = 0$

$x = 2.5 \times 10^{-3} = [H^+]$

$P_H = 2.59$

% Ionized
 $\frac{Part}{Whole} \times 100 = \frac{2.5 \times 10^{-3}}{2.22 \times 10^{-2}} \times 100 = 11.26\% \text{ ionized.}$

Mar 17-8:26 AM

Polyprotic Acids

$H_2CO_3 \rightarrow H^+ + HCO_3^-$
 A ONE PROTON! conjugate Base

$K_{a1} = \frac{[H^+][HCO_3^-]}{[H_2CO_3]}$
 dissociate the 1st H⁺

$HCO_3^- \rightarrow H^+ + CO_3^{2-}$
 A conjug. Base

$K_{a2} = \frac{[H^+][CO_3^{2-}]}{[HCO_3^-]}$
 2nd H⁺ that dissociates

Mar 17-8:36 AM

$$H_2CO_3 \rightarrow H^+ + HCO_3^- \quad K_{a1} = 4.3 \times 10^{-7}$$

$$HCO_3^- \rightarrow H^+ + CO_3^{2-} \quad K_{a2} = 5.6 \times 10^{-11}$$

$$H_2CO_3 \rightarrow 2H^+ + CO_3^{2-} \quad K = K_{a1} * K_{a2}$$

If original concentration and K_a value is ≥ 5 decimal places apart you can mathematically ignore the " -x "

Mar 17-8:40 AM

PH=2

H_2CO_3	\rightarrow	H^+	$+ HCO_3^-$
I $1M$			
D $-x$		$+x$	$+x$
E $1-x$		x	x

$$K_{a1} = \frac{(x)(x)}{1-x} = 4.3 \times 10^{-7}$$

$$x = 6.557438 \times 10^{-4}$$

PH = 3.18326577221

(1st dissoc. only)

HCO_3^-	\rightarrow	H^+	$+ CO_3^{2-}$
I 6.557×10^{-4}			
D $-x$		$+x$	$+x$
E $6.557 \times 10^{-4} - x$		x	x

$$K_{a2} = \frac{(H^+)(CO_3^{2-})}{[HCO_3^-]} = 5.6 \times 10^{-11}$$

$$K_a = \frac{(6.557 \times 10^{-4})(x)}{6.557 \times 10^{-4}} = 5.6 \times 10^{-11}$$

$$x = 5.6 \times 10^{-11} \text{ (H}^+\text{) more}$$

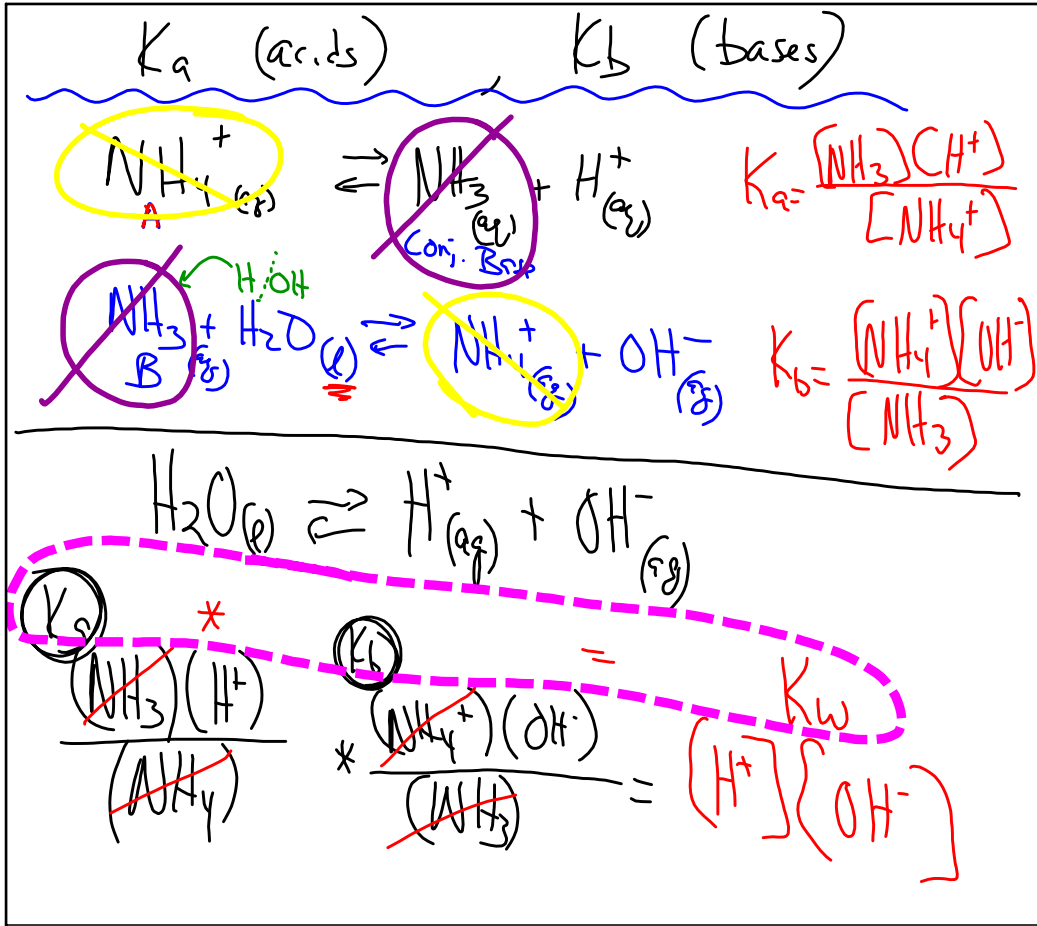
H^+ from K_{a1} + 5.6×10^{-11} $[H^+]_{\text{from } K_{a2}} = 6.557438 \times 10^{-4}$

PH = 3.18326576985

8th decimal slight change

Most H^+ comes out in K_{a1} ! K_{a2} and K_{a3} insignificant

Mar 17-8:43 AM



Mar 17-9:01 AM

$K_a \times K_b = K_w$
 1×10^{-14} at 25°C

Find pH of 0.1 M ClO^-

If NO H^+ OR OH^- ... Add water (H_2O or $\text{H}_2\text{O} + \text{H}_2\text{O}$)

$\text{ClO}^- + \text{H}_2\text{O} \rightleftharpoons \text{HClO} + \text{OH}^-$

I	0.1			
A	$-x$		$+x$	$+x$
E	$0.1-x$		x	x

$K_b = \frac{(x)(x)}{0.1} = 3.33 \times 10^{-7}$

$K_a = 3 \times 10^{-8}$
 HClO

$x^2 = 3.33 \times 10^{-8}$

$x = 1.83 \times 10^{-4} = [\text{OH}^-]$

$\text{pOH} = 3.74$

$\text{pH} = 10.26$

$K_a \times K_b = K_w$
 $3 \times 10^{-8} \times K_b = 1 \times 10^{-14}$
 $K_b = 3.33 \times 10^{-7}$

Mar 17-9:08 AM

polyprotic acid dissociation, $K_a \times K_b = K_w$, when to ignore x, WB dissociation.

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16.76 $[OH^-] = ?$ $PH = ?$ $0.55M BrO^-$ $K_b = 4 \times 10^{-6}$

	BrO^-	+	H_2O	\rightleftharpoons	$HBrO$	+	OH^-
I	0.55				0		0
D	-x				+x		+x
E	$0.55 - x$				x		x

$K_b = \frac{(x)(x)}{0.55} = 4 \times 10^{-6}$

$x^2 = 2.2 \times 10^{-6}$

$x = 1.48 \times 10^{-3} = [OH^-]$

$pOH = 2.83$

$PH = 11.17$

Mar 17-9:23 AM

HW PS 16-1

1-22 even

#14 Chloroacetic acid $K_a = 1.4 \times 10^{-3}$

Large K_a SA

Small K_a WA

Mar 17-9:29 AM