

April 1, 2002

■ Quiz Review

■ Problem Session Today (A531 Cook; 3-4 pm)

➤ *It's "Double Quiz" Week!*

☺ Comprehensive

☺ Counts TRI PLE

☺ Replaces the Final Exam

☺ No Partial credit!

☺ No Periodic Table

☺ Can't use a writing implement!

☺ Must communicate your answers telepathically

☺ Must use only Sanskrit or another dead language

☺ If you can read this, you don't need glasses!

☺ If you can read this, you may have won 1 million dollars!

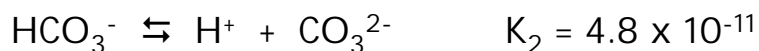
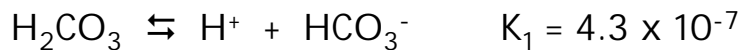
© Heavy April Fools Day

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Polyprotic Acids

➤ What if an acid has more than one acidic proton?

Example: H_2CO_3



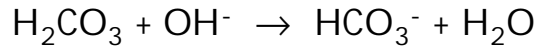
If $K_1 \gg K_2$: Treat as *separate acids*

2

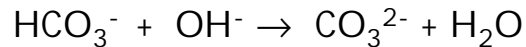
Titration of H_2CO_3

Reaction with OH^- occurs *stepwise*:

H_2CO_3 reacts first:



HCO_3^- reacts only once all H_2CO_3 is gone:



H_2CO_3 : Weak Acid $\text{H}_2\text{CO}_3/\text{HCO}_3^-$: Buffer
 CO_3^{2-} : Weak Base $\text{HCO}_3^-/\text{CO}_3^{2-}$: Buffer

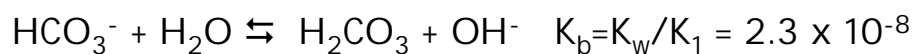
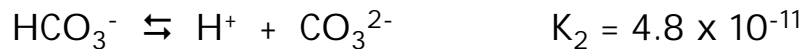
HCO_3^- : *Amphoteric* (acts as both acid and a base)

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Dealing with HCO_3^-

➤ Will a solution of HCO_3^- be acidic or basic?

Two equilibria:



$K_b > K_2$, so HCO_3^- is a stronger *base* than acid
(solution will be basic)

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Quantitatively?

➤ It can be shown that:

$$[H^+] = \left[\frac{K_1 K_2 [HA^-] + K_1 K_w}{K_1 + [HA^-]} \right]^{1/2}$$

✓ But HCO_3^- is such a weak acid/base that it dissociates very little: $[HCO_3^-] \approx C_{HCO_3^-}$

✓ Also, if: $C_{HCO_3^-} \gg K_1$ and $K_2 \gg K_w$

THEN: $[H^+] = (K_1 K_2)^{1/2}$ (pH = $\frac{1}{2}[pK_1 + pK_2]$)

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