

Let's think about Acids

What is in solution?

Which of the following is amphiprotic?

- | | | | |
|----|---------------------------|-------------|------------------------|
| A. | H_3PO_4 | Weak Acid | H_3A |
| B. | NaH_2PO_4 | Amphiprotic | H_2A^- |
| C. | K_3PO_4 | Weak Base | A^{3-} |
| D. | NaCl | Spectator | |
| E. | Na_3PO_4 | Weak Base | A^{3-} |

What is in solution?

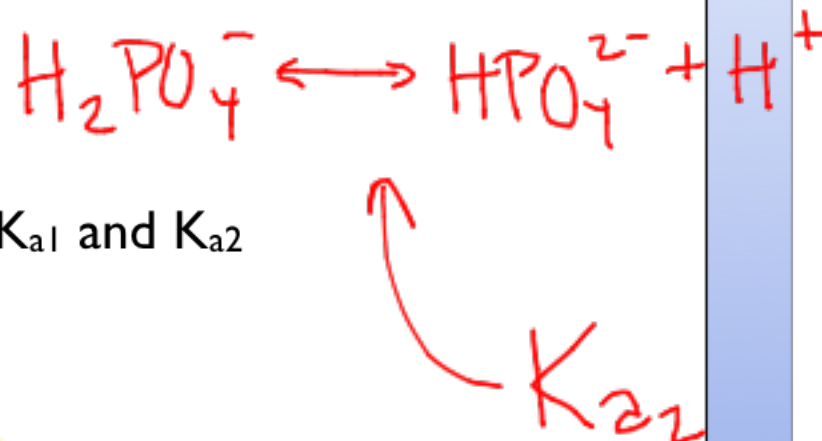
If I add 0.1 moles of NaOH to 0.07 moles of H_3PO_4 what will be the dominant species in solution?

A.	H_3PO_4 and H_2PO_4^-	$\text{OH}^- + \text{H}_3\text{A} \rightarrow \text{H}_2\text{A}^-$
B.	H_2PO_4^-	.1 .07 0
C.	H_2PO_4^- and HPO_4^{2-}	-.07 -.07 +.07
D.	HPO_4^{2-}	<hr/>
E.	HPO_4^{2-} and PO_4^{3-}	.03 ϕ .04
		$\text{H}_2\text{A}^- + \text{OH}^- \rightarrow \text{HA}^{2-}$
		.04 .03 0
		-.03 -.03 +.03
		<hr/>
		.01 0 .03

How would I find the pH

If I add 0.1 moles of NaOH to 0.07 moles of H_3PO_4
how would I solve for the pH

- A. It will be a weak acid
- B. It will be amphiprotic between K_{a1} and K_{a2}
- C. It will be a buffer around K_{a1}
- D. It will be a buffer around K_{a2}
- E. It will be a weak base

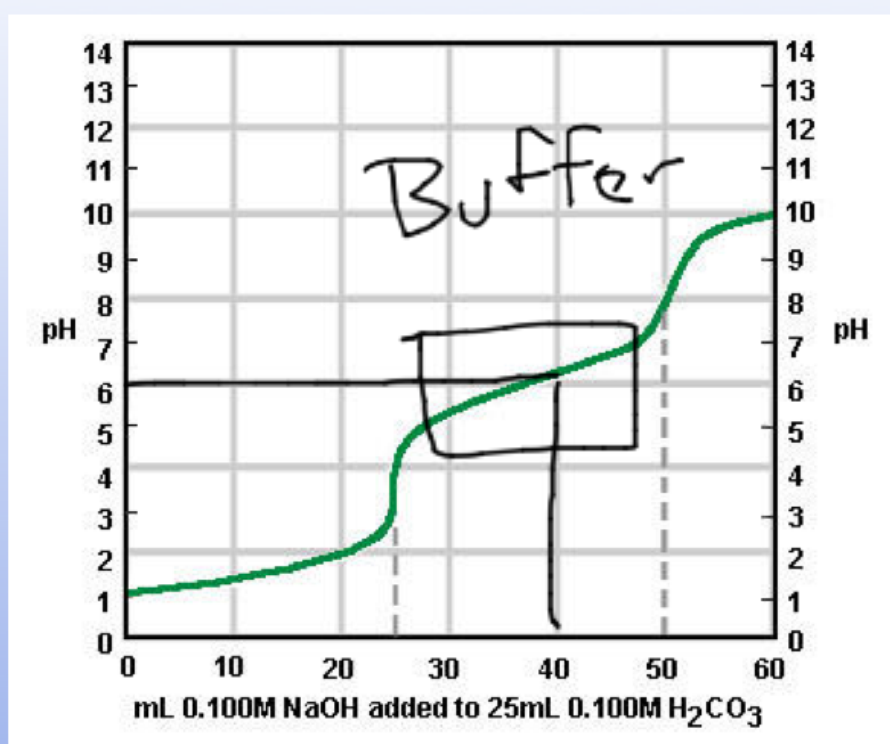


How would I find the pH

If I add 0.15 moles of NaOH to .05 moles of H_3PO_4
how would I solve for the pH

- A. It will be a weak acid
- B. It will be amphiprotic between K_{a1} and K_{a2}
- C. It will be a buffer around K_{a1}
- D. It will be a buffer around K_{a2}
- E. It will be a weak base
- Handwritten notes:
3X OH^- compared to H_3A
neutralizes all 3 protons $\rightarrow \text{A}^{3-}$

Titration of H₂CO₃



What is (are) the dominant species at pH = 6?

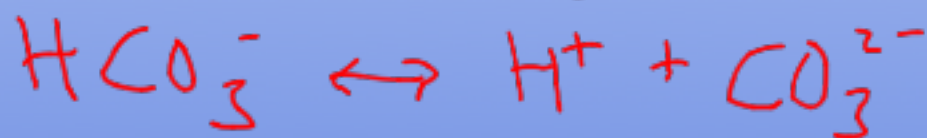
A. H₂CO₃/HCO₃⁻

B. HCO₃⁻

C. HCO₃⁻ / CO₃²⁻

D. CO₃²⁻

2nd 1/2 equiv. pt.



Recognizing a buffer

Which of the following will form a buffer?

- A. 100 mL of 1M HCl and 100 mL 1M of NaF *all F⁻ weak base*
- B. 100 mL of 1M HCl and 50 mL of 1M NaOH *all strong*
- C. 100 mL of 1M HCl and 50 mL of 1M NaCl *all strong*
- D. 100 mL of 1M HCl and 50 mL of 1M NH₃ *too much H⁺*
- E. 100 mL of 1M HCl and 200 mL of 1M Na(CH₃COO)

Solubility and Acids and Bases

Which of the following will form a buffer?

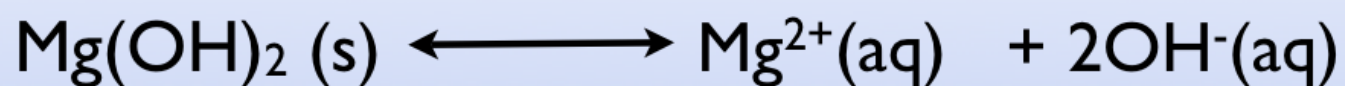
- A. 100 mL of 1M HCl and 100 mL 1M of NaF
- B. 100 mL of 1M HCl and 50 mL of 1M NaOH
- C. 100 mL of 1M HCl and 50 mL of 1M NaCl
- D. 100 mL of 1M HCl and 50 mL of 1M NH₃
- E. 100 mL of 1M HCl and 200 mL of 1M Na(CH₃COO)

Rolaids® contain about 0.1 g of Magnesium Hydroxide
Why in the world would you ever put such a thing in
your mouth?

- A. 0.1 g is nothing. I eat 10-20 g NaOH daily just for laughs
- B. Acids are dangerous by bases as quite safe
- C. The saliva in my mouth is acidic enough to "handle it"
- D. $\text{Mg}(\text{OH})_2$ is not soluble in water

$\text{Mg}(\text{OH})_2$ must be insoluble or it
would be a strong base

Solubility Equilibria



$$K_{\text{sp}} = [\text{Mg}^{2+}][\text{OH}^{-}]^2 = 5.6 \times 10^{-12}$$

OH^{-} that is dissolved neutralizes any H^{+}
then more OH^{-} dissolves...repeat

end result is a very slightly basic solution

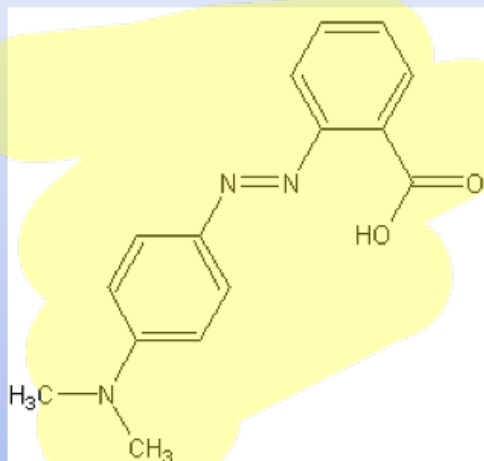
What happens in our bubbling experiment to make the solution clear?

- A. the indicator dye evaporates
- B. the solution becomes more acidic
- C. the solution becomes more alkaline (basic)
- D. the solution becomes too dilute to see the color

Thinking about acid/base chemistry

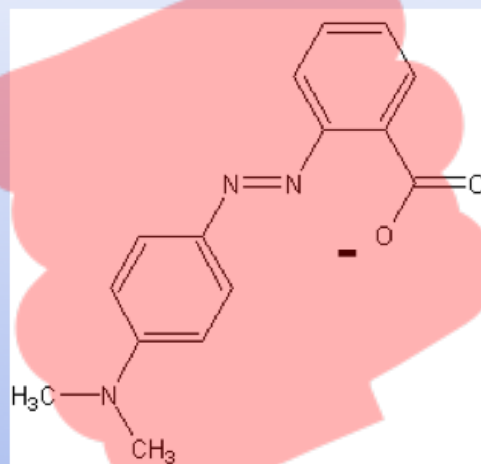
~~Methyl Red~~

pKa = 5.2



HA

pH < 5.2



A⁻ Yellow

pH > 5.2



~~Red~~ YELLOW ~~Yellow~~ RED

What happens in our bubbling experiment to make the solution clear?

- A. the indicator dye evaporates
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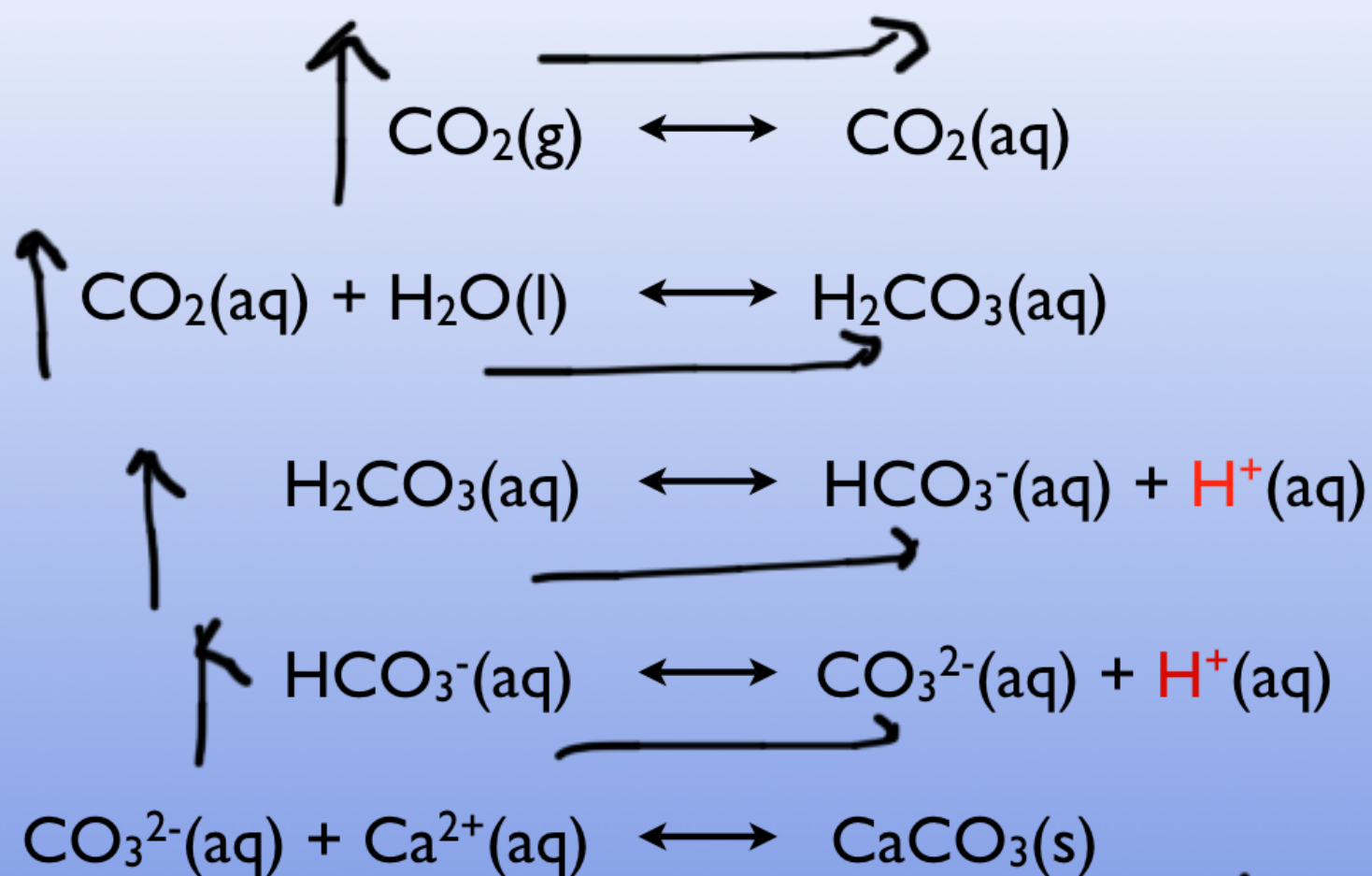
What makes the solution acidic?

- A. dissolved oxygen gas
- B. dissolved nitrogen gas
- C. dissolved carbon dioxide gas
- D. saliva

What is one consequence of increased CO_2 in the Earth's atmosphere?

- A. oceans becoming more acidic
- B. oceans becoming more alkaline (basic)

What makes the solution acidic?



More H^+

In Austin (and most places) water out of the tap is

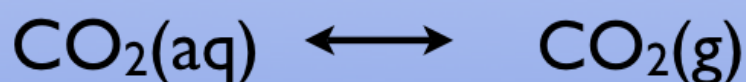
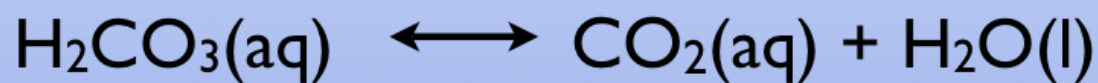
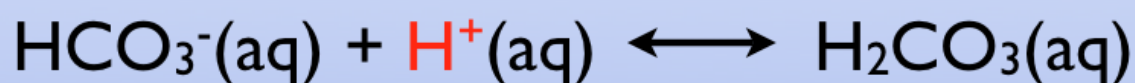
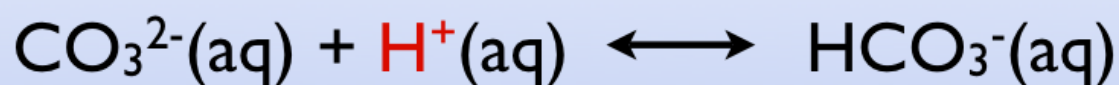
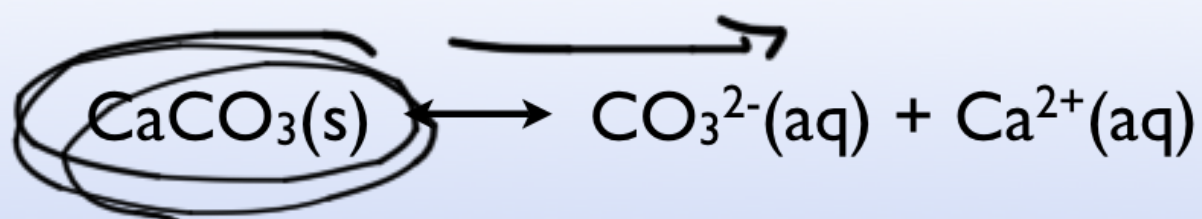
- A. neutral
- B. slightly acidic
- C. slightly basic

In Austin (and most places) water out of the tap is

- A. neutral
- B. slightly acidic
- C. slightly basic

because the ground is full of limestone (CaCO_3)

What makes the solution acidic?

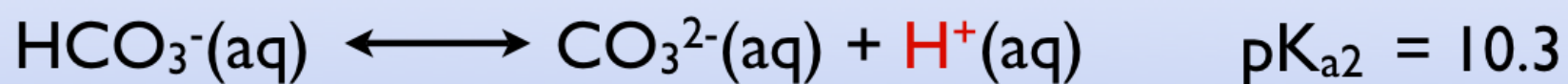
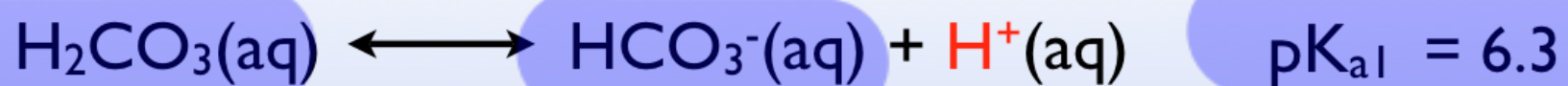


"consumes"

$\text{H}^+ \rightarrow \text{BASIC}$

If I add alot of NaHCO_3 to an HCl solution the predominate species in solution will be

- A. H^+
- B. H_2CO_3 and HCO_3^-
- C. only HCO_3^-
- D. HCO_3^- and CO_3^{2-}
- E. only CO_3^{2-}



The pH of my “solution” will be

- A. around 3
- B. around 6
- C. around 8
- D. around 10

