Let's think about Acids

# What is in solution?

## Which of the following is amphiprotic?

A. $H_3PO_4$

B. $NaH_2PO_4$

C. $K_3PO_4$

D. NaCl

E. $Na_3PO_4$

# 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 $H_2PO_4^-$

B. $H_2PO_4^-$

C. $H_2PO_4^-$ and $HPO_4^{2-}$

D. $HPO_4^{2-}$

E. $HPO_4^{2-}$ and $PO_4^{3--}$

# 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

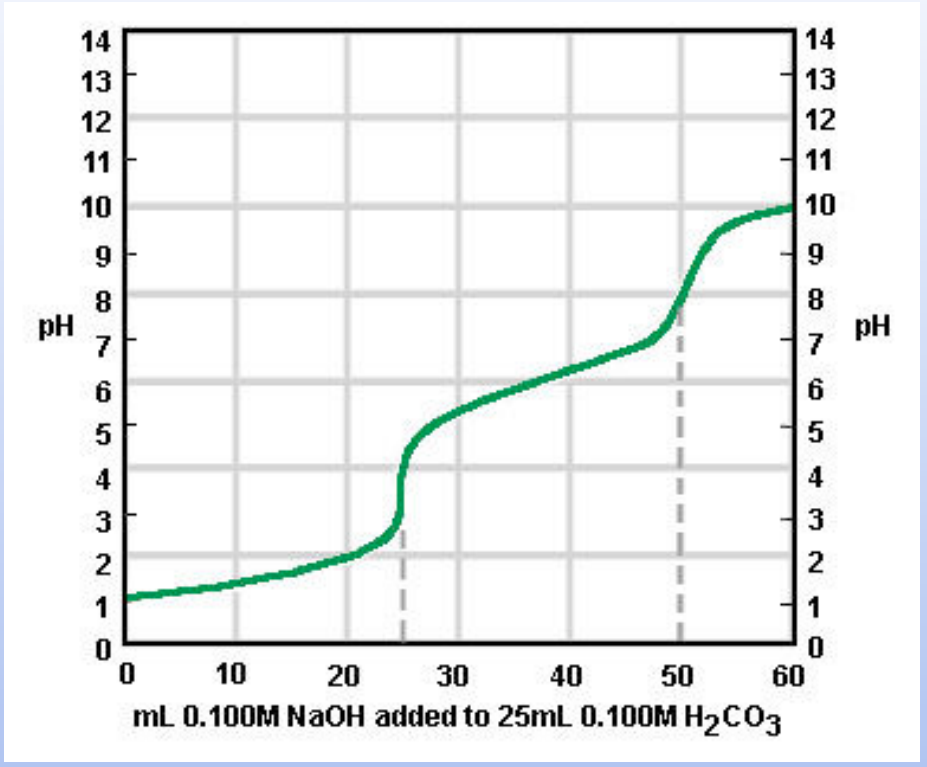
B. It will be amphiprotic between $K_{a1}$ and $K_{a2}$

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

# Titration of $H_2CO_3$




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

A. $H_2CO_3/HCO_3^-$

B. $HCO_3^-$

C. $HCO_3^-$ /$CO_3^{2-}$

D. $CO_3^{2-}$

# Recognizing a buffer

## 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 $NH_3$

E. 100 mL of 1M HCl and 200 mL of 1M $Na(CH_3COO)$

# 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 $NH_3$

E. 100 mL of 1M HCl and 200 mL of 1M $Na(CH_3COO)$

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. $Mg(OH)_2$ is not soluble in water

# Solubility Equilibria

$$Mg(OH)_2\,(s) \longleftrightarrow Mg^{2+}(aq) + 2OH^-(aq)$$

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

$OH^-$ 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

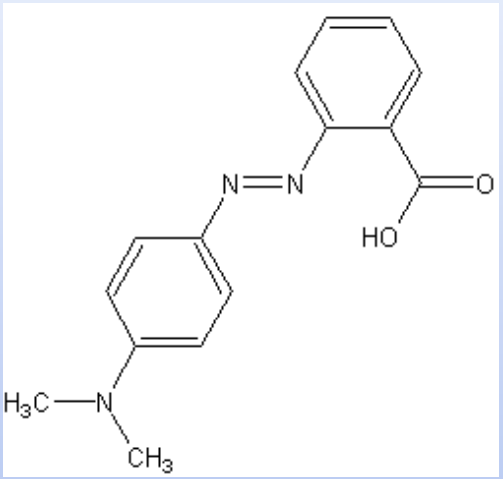
C. the solution becomes more alkaline (basic)

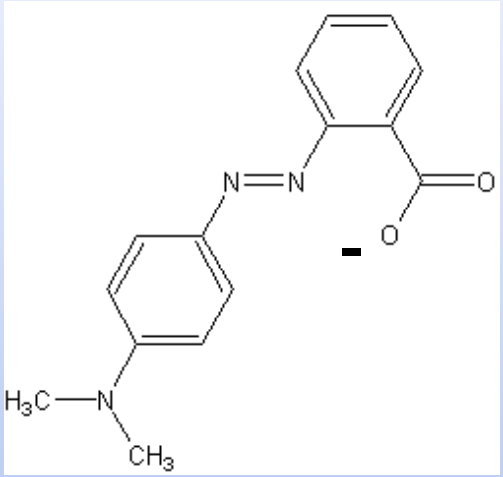
D. the solution becomes too dilute to see the color

# Thinking about acid/base chemistry

## Methyl Red

pKa = 5.2




HA Red

$A^-$ Yellow

pH < 5.2

pH > 5.2

$$\frac{\text{Red}}{\text{Yellow}} > 1$$

$$\frac{\text{Red}}{\text{Yellow}} < 1$$

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

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?

$$CO_2(g) \longleftrightarrow CO_2(aq)$$

$$CO_2(aq) + H_2O(l) \longleftrightarrow H_2CO_3(aq)$$

$$H_2CO_3(aq) \longleftrightarrow HCO_3^-(aq) + H^+(aq)$$

$$HCO_3^-(aq) \longleftrightarrow CO_3^{2-}(aq) + H^+(aq)$$

$$CO_3^{2-}(aq) + Ca^{2+}(aq) \longleftrightarrow CaCO_3(s)$$

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

A. neutral

B. slightly acidic

C. slightly basic

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

A. neutral

B. slightly acidic

C. slightly basic

because the ground if full of limestone ($CaCO_3$)

What makes the solution acidic?

$$CaCO_3(s) \longleftrightarrow CO_3^{2-}(aq) + Ca^{2+}(aq)$$

$$CO_3^{2-}(aq) + H^+(aq) \longleftrightarrow HCO_3^-(aq)$$

$$HCO_3^-(aq) + H^+(aq) \longleftrightarrow H_2CO_3(aq)$$

$$H_2CO_3(aq) \longleftrightarrow CO_2(aq) + H_2O(l)$$

$$CO_2(aq) \longleftrightarrow CO_2(g)$$

If I add alot of NaHCO3 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 $CO_3^{2-}$

$H_2CO_3(aq) \longleftrightarrow HCO_3^-(aq) + H^+(aq)$ $pK_{a1} = 6.3$

$HCO_3^-(aq) \longleftrightarrow CO_3^{2-}(aq) + H^+(aq)$ $pK_{a2} = 10.3$

The pH of my "solution" will be

A. around 3

B. around 6

C. around 8

D. around 10