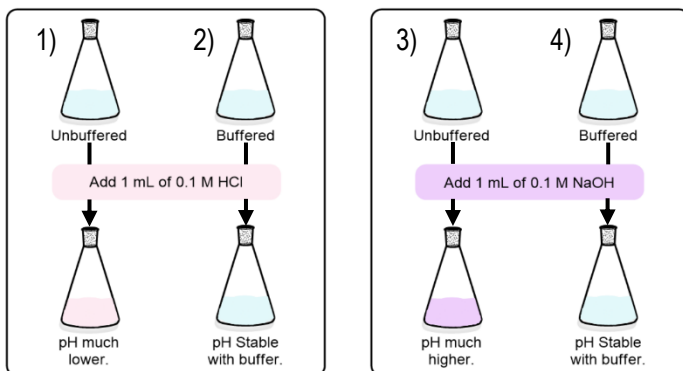## CONCEPT: BUFFER SOLUTION

1) Buffers

●*Buffer*: substance that _____ changes in pH when small/moderate amounts of strong acid/base are added.

EXAMPLE:

*The *Henderson-Hasselbalch* equation can be used to _____ buffer solutions.

Henderson-Hasselbalch Equation

$$pH = pK_a + \log\frac{[\text{Conjugate Base}]_f}{[\text{Conjugate Acid}]_f}$$

PRACTICE: A) What volume of 0.1 M acetic acid (pK_a = 4.8) is required to make 1 liter of 0.1 M buffer solution at pH = 5.8?

a) 193 mL

b) 91 mL

c) 909 mL

d) 807 mL

B) What volume of 0.1 M sodium acetate is required?

a) 193 mL
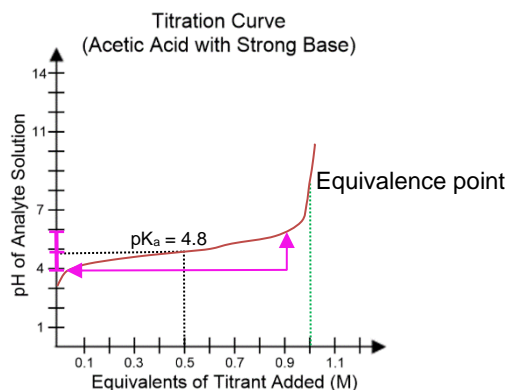
b) 91 mL

c) 909 mL

d) 807 mL

2) Effective Buffers

●Weak acids/bases & their _____ together create effective buffers.

●The effective buffering _____ of a weak acid is centered around the inflection point & the pK_a.

□ The effective buffer range is ±___ of the pK_a.

EXAMPLE: Effective Buffer Range of Acetic Acid.

Acetic Acid → H+ → Acetate

$$CH_3COOH \longrightarrow CH_3COO^-$$
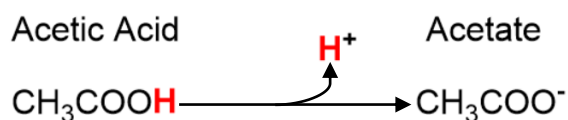
pK_a = 4.8

Acetic Acid Buffer Range: _____ to _____

Titration Curve
(Acetic Acid with Strong Base)

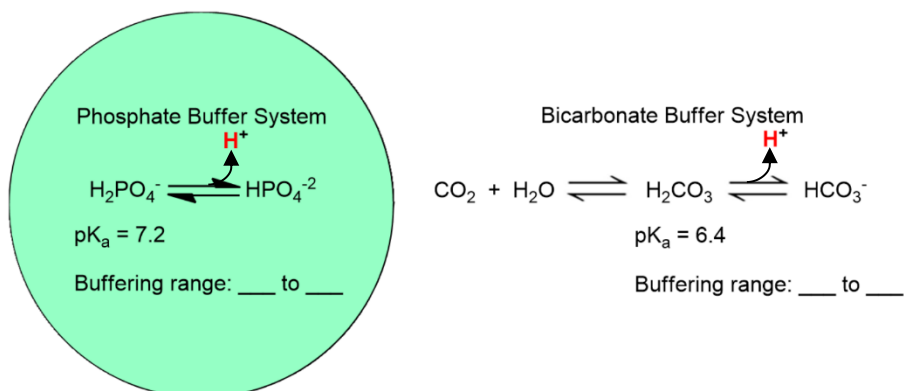<u>**CONCEPT:**</u> <u>BUFFER SOLUTION</u>

PRACTICE: Which of the following compounds would make for the best buffer at pH 8?

    a) Acetic acid, $pK_a = 4.8$

    b) Tricine, $pK_a = 8.15$

    c) Glycine, $pK_a = 9.9$

    d) Tris, $pK_a = 8.3$

3) <u>Biological Buffers</u>

●Buffers are critical to life! Living systems use weak acids as buffers & a way to maintain _____.

    □ Some buffers maintain intracellular pH whereas others maintain _____ pH.

●The _____ buffer system (HPO_4^{-2} / $H_2PO_4^-$) maintains intracellular pH.

●The _____ buffer system maintains extracellular pH.

EXAMPLE:

Phosphate Buffer System

H^+

$H_2PO_4^- \rightleftharpoons HPO_4^{-2}$

$pK_a = 7.2$

Buffering range: ___ to ___

Bicarbonate Buffer System

H^+

$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons HCO_3^-$

$pK_a = 6.4$

Buffering range: ___ to ___

PRACTICE: MOPS ($pK_a = 7.2$) is a weak acid & acts as a buffer. Calculate the ratio of its basic/acidic species at pH = 6.0.

    a) 0.098

    b) 1.24

    c) 0.377

    d) 0.063