AP Unit 8 Test Review

#1.) What will change the pH of a buffer?

✗ I) 2 x (acid and conjugate base) ← Nope: didn't affect $HA:A^-$ ratio

✗ II) 2 x H_2O

✓ III) Add small amount of strong acid or strong base] Yep: changed $HA:A^-$ ratio

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#2.) 0.75 M weak acid, $K_a = 6.6 \times 10^{-5}$ ⇒ % ion.?

$$K_a = \frac{x^2}{[HA]} = \frac{x^2}{0.75} = 6.6 \times 10^{-5}$$

$$\Rightarrow x = [H_3O^+] = \sqrt{(0.75)(6.6E\text{-}5)} = 0.0070\ M$$

$$\%\ Ion. = \frac{[H_3O^+]}{[HA]} \times 100 = \frac{0.0070}{0.75} \times 100 = \boxed{0.94\%}$$

#3.) 0.25 M H_2SO_4 ⇒ [ion] ↓ = ?

$H_2SO_4\ (aq) \longrightarrow H^+ + HSO_4^- \rightleftharpoons 2H^+ + SO_4^{2-}$

H_2SO_4: Strong ⇒ Completely dissociates = none left!

HSO_4^-: Weak acid, mostly stays together = lots present

SO_4^{2-}: very little

#4.) Best buffer combo for pH = 9.24?

⇒ Want $pK_a \approx pH = 9.24$

⇒ $K_a = 10^{-9.24} = \boxed{5.8 \times 10^{-10}}$ ← closest to $K_a = 5.7 \times 10^{-8}$

#5.) $NaCO_2H \rightarrow Na^+ + CO_2H^-$

Na^+: no hydrolysis; CO_2H^-: yes, hydrolysis

$$CO_2H^-(aq) + H_2O(l) \rightleftharpoons HCO_2H + OH^-$$

$$K_b = \frac{K_w}{K_a} = \frac{1E-14}{1.8E-4} = \boxed{5.6 \times 10^{-11}}$$

#6.) $M_1V_1 = M_2V_2$

$(0.3\ M)(250\ mL) = M_2(500\ mL) \Rightarrow M_2 = \frac{(0.3)(250)}{500} = 0.15\ M = [KOH] = [OH^-]$

$pOH = -\log[OH^-] = -\log(0.15) = 0.82$

$\Rightarrow pH = 14 - 0.82 = \boxed{13.18}$

#7.) pure H_2O, $pH = 7.35$

$\Rightarrow [H_3O^+] = [OH^-] = 10^{-pH} = 10^{-7.35} = \boxed{4.5 \times 10^{-8}\ M}$

#8.) 1:1 buffer $\Rightarrow pH = pK_a = 6.2$

*Add acid $\Rightarrow \boxed{\uparrow HA, \downarrow A^-} \Rightarrow \downarrow pH$

#9.) 0.10 M weak acid, $pH = 3$ $\Rightarrow$ what acid?

$[H_3O^+] = 10^{-pH} \approx 10^{-3} = x$

$$K_a = \frac{x^2}{[HA]} = \frac{(10^{-3})^2}{0.10} = \boxed{1 \times 10^{-5}}$$ ← closest to 1.9×10^{-5}

#10.) $\downarrow$ % Ion?

strong acid = 100% ionization!

$\frac{0.75\ mol}{0.500\ L} = 1.5\ M$ HBr or 1.5 M HCN

$\frac{0.75\ mol}{0.250\ L} = 3.0\ M$ HBr or 3.0 M HCN

for weak acids/bases,

↑ concentration = ↓ % ionization