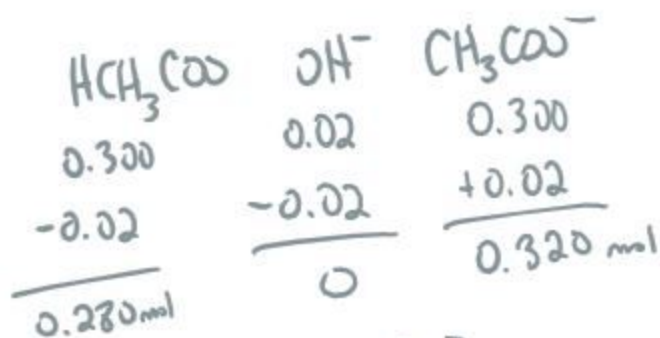
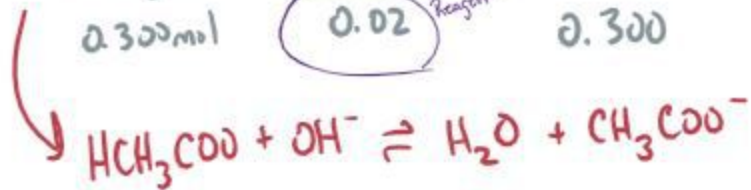
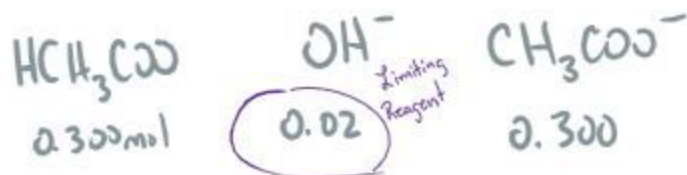


Ex: Buffer made by adding 0.300 mol $\text{HC}_2\text{H}_3\text{O}_2$ ($\text{pK}_a = 4.74$)
 and 0.300 mol $\text{NaC}_2\text{H}_3\text{O}_2$ to enough water to make 1L of soln
 Calc. pH after 0.020 mol of NaOH is added



$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]} = 4.74 + \underbrace{\log \frac{0.300}{0.300}}_0 = 4.74$$

Initial pH



$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]} = 4.74 + \log \frac{0.320}{0.280} = 4.80$$

Final pH

↳ compare to pH of adding 0.020 mol NaOH to
1 L pure water.

Pure H_2O = pH of 7

$$[OH^-] = \frac{0.020 \text{ mol}}{1 \text{ L}}$$

$$= 0.02 \text{ M}$$

final pH:

$$pOH = -\log(0.02) = 1.70$$

$$pH = 14 - 1.70 = 12.3$$

2 methods
for
creating
buffer
soln
(equivalent)



① 0.300

0.300

0

② 0.600

0.300

0

- 0.300

- 0.300

+ 0.300

final: 0.300

0

0.300



$$\begin{array}{cc} 0.100 & 0.05 \end{array}$$

$$\begin{array}{r} -0.05 \\ \hline \end{array}$$

$$0.05$$

$$\begin{array}{r} -0.05 \\ \hline 0 \end{array}$$

$$+ 0.05$$

$$0.05$$

$$\text{pH} = \text{pK}_a + \log \frac{[\text{A}^-]}{[\text{HA}]}$$

$$\text{pH} = \text{pK}_a + \log \frac{(0.05)}{(0.05)}$$

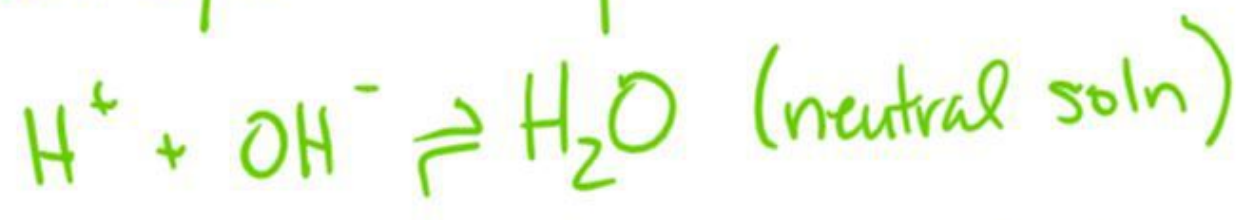
$$\text{pH} = \text{pK}_a$$

$$\text{pK}_a = -\log(4.9 \times 10^{-10}) = 9.3$$

$$\text{pH} = 9.3$$

Titration = use concentration of a known acid/base to figure out the unknown concentration of an acid/base

↳ trying to reach equivalence point where:



↳ moles of acid = moles of base

$$\text{moles H}^+ = \text{mole OH}^-$$

$$M_a V_a = M_b V_b$$

Calc. pH when a) 40.0 mL and b) 49.0 mL and c) 49.95 mL of 0.100 M NaOH have been added to 50 mL of 0.100 M HCl soln

$$\text{Initial pH} = -\log(0.100) = 1.00$$

a) 40 mL of NaOH

$$(0.050 \text{ L})(0.100) = 0.0050 \text{ moles } \text{H}^+$$

$$(0.04 \text{ L})(0.100) = 0.0040 \text{ mol } \text{OH}^-$$



I	0.0050	0.0040	
C	-0.0040	-0.0040	
E			
	0.0010 mol	0	

$$\text{pH} = -\log[\text{H}^+]$$

$$= -\log\left(\frac{0.0010 \text{ mol}}{(0.05 + 0.04)}\right) = 1.95$$