CHEM 160 BUFFERS

Determine the pH of a solution containing 386 mL of 0.7M acetic acid (Ka=1.8 x 10^{-5}) and 100 mL of 1.0M NaOH

1. Determine the amount of moles of acid and base

386 mL x (1L / 1000 mL) = 0.386 L 0.386 L x (0.7 mol / 1L) = 0.270 mols of acetic acid

100 mL x (1L / 1000 mL) = 0.1 L 0.1 L x (1.0 mol / 1L) = 0.100 mols of NaOH

2. Determine the limiting reagent

Since the reaction is a one to one ratio, NaOH is the LR because it has the least amount of moles

	CH_3COOH	+ NaOH →	Na^+ + CH_3COO^- + H_2O
I	0.27 mol	0.1 mol	0
C	-0.1 mol	-0.1 mol	+0.1 mol
E	0.17 mol	0 mol	0.1 mol

3. Determine final concentrations

New volume: 0.386L + 0.100L = 0.486L

Concentration of CH_3COO^- : 0.1 mols / 0.486 L = **0.21M**
Concentration of CH_3COOH : 0.17 mols / 0.486 L = **0.35M**

4. Determine the pKa from Ka

-log(1.8 x 10^{-5}) = **4.74**

5. Use Henderson-Hasselbach equation

pH = pKa + log (A-/HA)

pH = 4.74 + log (0.21/0.35)
pH = 4.74 + (-0.22)
pH = 4.52

*Note: When in a buffer solution, pH should stay within pKa +/- 1.
Does this make sense? The concentration of the acid is a little higher than the concentration of the base, therefore the new pH should be lower than the original pH.

4.52 < 4.74. Yes!