

Chemistry 1210
Acid/base practice problems

- 1) Calculate the pH and pOH (at 25°C, where $K_w = 1.0 \times 10^{-14}$) of the following mixtures:
- 25.00 mL of 0.02015 M Ca(OH)_2 and 12.75 mL of 0.04182 M HBr.
[pH = 12.10, pOH = 1.90]
 - 25.00 mL of 1.000 M HF ($K_a = 3.53 \times 10^{-4}$). **[pH = 1.73, pOH = 12.27]**
 - 25.00 mL of 1.000 M HF and 5.00 mL of 1.25 M NaOH. **[2.98/11.02]**
 - 25.00 mL of 1.000 M HF and 10.00 mL of 1.25 M NaOH **[3.45/10.55]**
 - 25.00 mL of 1.000 M HF and 15.00 mL of 1.25 M NaOH **[3.93/10.07]**
 - 25.00 mL of 1.000 M HF and 20.00 mL of 1.25 M NaOH **[8.60/5.40]**
 - 25.00 mL of 1.000 M HF and 25.00 mL of 1.25 M NaOH **13.10/0.90]**
 - 25.00 mL of 1.000 M H_2SO_4 . K_{a2} for $\text{H}_2\text{SO}_4 = 1.1 \times 10^{-2}$ **[-0.005/14.005]**
 - 10.00 mL of 1.000 M NH_3 ($K_b = 1.75 \times 10^{-5}$) **[11.62/2.38]**
 - 10.00 mL of 1.000 M NH_3 and 5.00 mL of 1.000 M HCl **[9.24/4.76]**
 - 10.00 mL of 1.000 M NH_3 and 10.00 mL of 1.000 M HCl **[4.77/9.23]**
 - 10.00 mL of 1.000 M NH_3 and 15.00 mL of 1.000 M HCl **[0.70/13.30]**
- 2) Calculate the ratio of $[\text{H}_3\text{PO}_4]:[\text{H}_2\text{PO}_4^-]:\{\text{HPO}_4^{2-}\}:[\text{PO}_4^{3-}]$ in a solution with a pH of 7. If you were going to make a buffer of pH 7.00 and only allowed to use two of H_3PO_4 , NaH_2PO_4 , Na_2HPO_4 , and Na_3PO_4 , which would you pick? **[5.32 : 3.78 x 10⁵ : 2.38 x 10⁵ : 1]**
- 3) A certain indicator has a $\text{pK}_{\text{ind}} = 2.30$. You use it in the titration of 10.00 mL of 0.1000 M HCl with 0.1000 M NaOH. At what added volume of NaOH will the indicator change colour? Does this make it a good or a bad indicator for this titration? **[9.05 mL, no]**
- 4) Calculate the pH of a 5.0×10^{-9} M solution of HCl (at 25°C, where $K_w = 1.0 \times 10^{-14}$) **[6.989]**.

*The next question is **extremely** difficult. It is of bonus-question caliber and should not be attempted until all other questions have been answered correctly.*

- 5) H_2SO_4 has a K_{a2} of 1.1×10^{-2} . How many mL of 1.000 M Na_2SO_4 must be added to 800.0 mL of 0.5000 M H_2SO_4 to create a buffer of pH 1.75? **[847.4]**