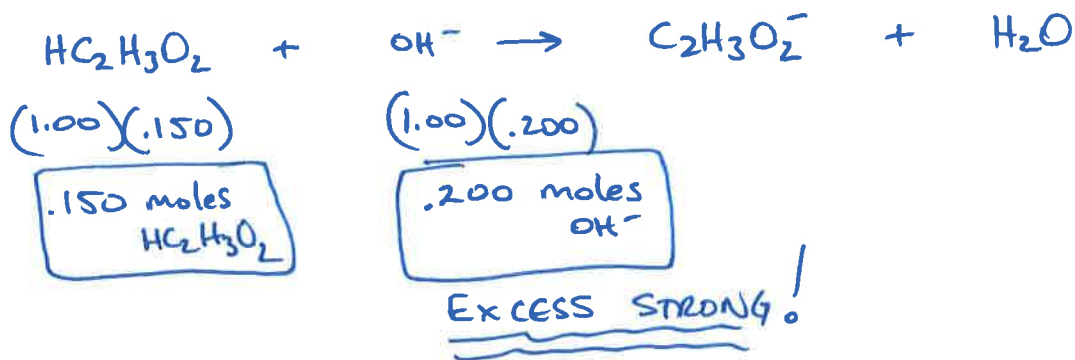


Acid – Base Titration Problems Interactive Practice
Strong & Strong, Strong & Weak, Equiv Point

1. Calculate the pH of the resulting solution that is formed when 200. mL of 1.00 M NaOH is added to 150. mL of 1.00 M HC₂H₃O₂.

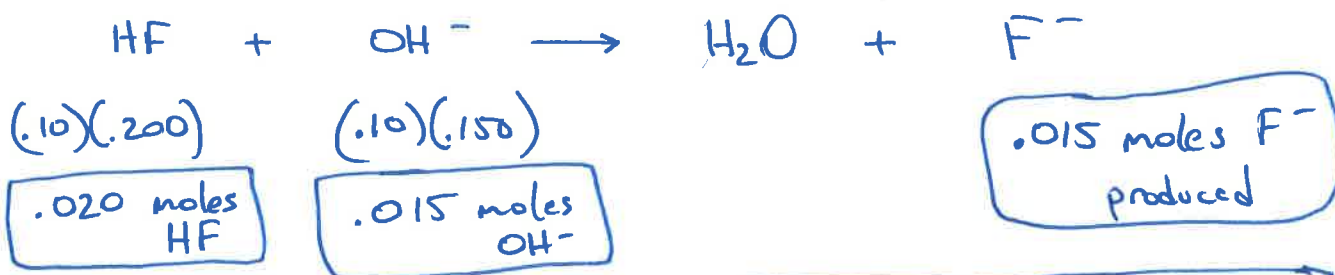


$$\begin{array}{r} .200 \\ - .150 \\ \hline .050 \end{array} \text{ moles leftover OH}^-$$

$$[\text{OH}^-] = \frac{.050}{.350} = .14 \text{ M}$$

POH = .85
PH = 13.15

2. Calculate the pH of the solution that is formed by adding 150. mL of 0.10 M NaOH to 200.0 mL of 0.10 M of HF.



$$\begin{array}{r} .020 \\ - .015 \\ \hline .005 \end{array} \text{ moles HF leftover}$$

TOTAL VOLUME = .350 Liters



$$K_a = 6.8 \times 10^{-4} = \frac{[x][.043+x]}{[.014-x]} \quad x = 2.2 \times 10^{-4} \text{ M} = [\text{H}_3\text{O}^+]$$

PH ≈ 3.66

3. Calculate the pH at the **equivalence point** in a titration reaction involving 50.0 mL of 1.00 M HCl with 1.500 M NH₃.



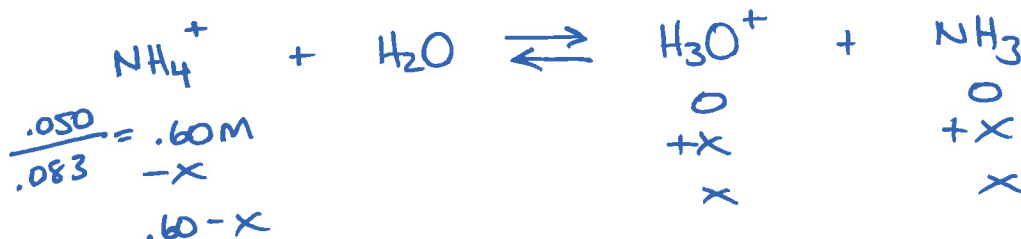
$$\boxed{.050 \text{ moles NH}_3} = \boxed{(1.00)(.050) \text{ moles H}^+}$$

$$\boxed{.050 \text{ moles NH}_4^+ \text{ produced}}$$

$$.050 = (1.500)(V)$$

$$\boxed{V = .033 \text{ Liters NH}_3 \text{ needed}}$$

$$\boxed{\text{TOTAL VOLUME} = .083 \text{ Liters}}$$



$$K_a = 5.6 \times 10^{-10} = \frac{x^2}{[.60-x]}$$

$$x = 1.8 \times 10^{-5} \text{ M} = [\text{H}_3\text{O}^+]$$

$$\boxed{\text{pH} = 4.74}$$

4. What is the pH of the resulting solution formed by adding 350 mL of 0.100 M HCl to a beaker containing 220 mL of 0.20 M NaOH?



$$(1.00)(.35)$$

$$(.20)(.22)$$

$$\boxed{.035 \text{ moles H}^+}$$

$$\boxed{.044 \text{ moles OH}^-}$$

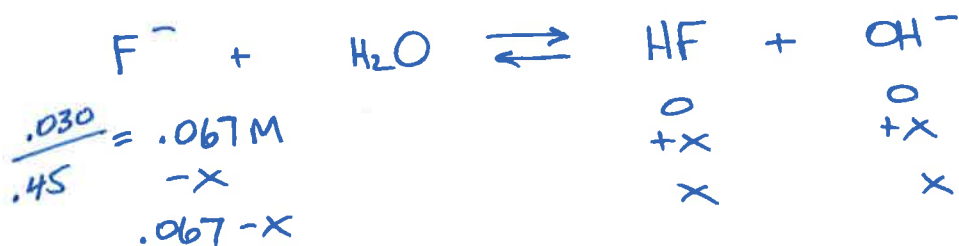
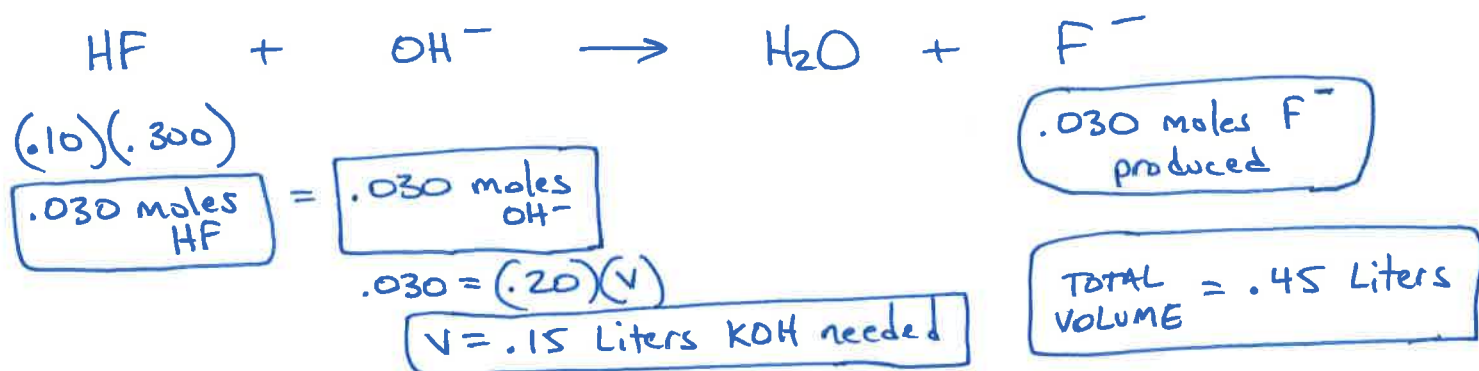
$$.044 - .035 = \boxed{.009 \text{ moles OH}^- \text{ leftover}}$$

$$\frac{.009}{.570} = .016 \text{ M} = [\text{OH}^-]$$

$$\text{pOH} = 1.80$$

$$\boxed{\text{pH} = 12.20}$$

5. Calculate the pH at the **equivalence point** in a titration reaction involving 300.0 mL of 0.10 M HF with 0.20 M KOH.



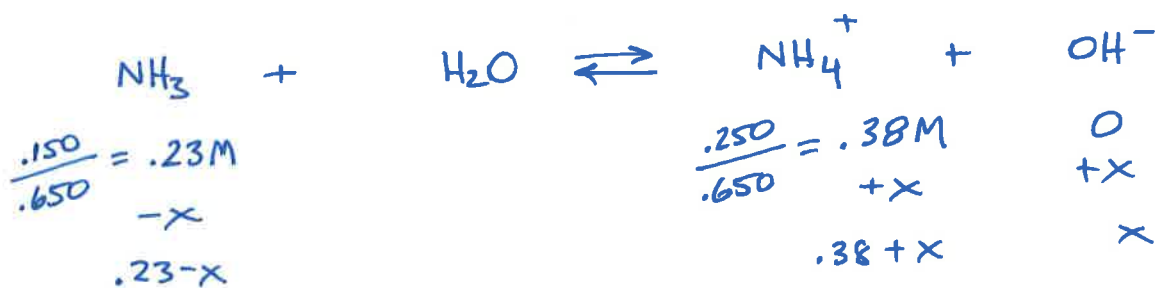
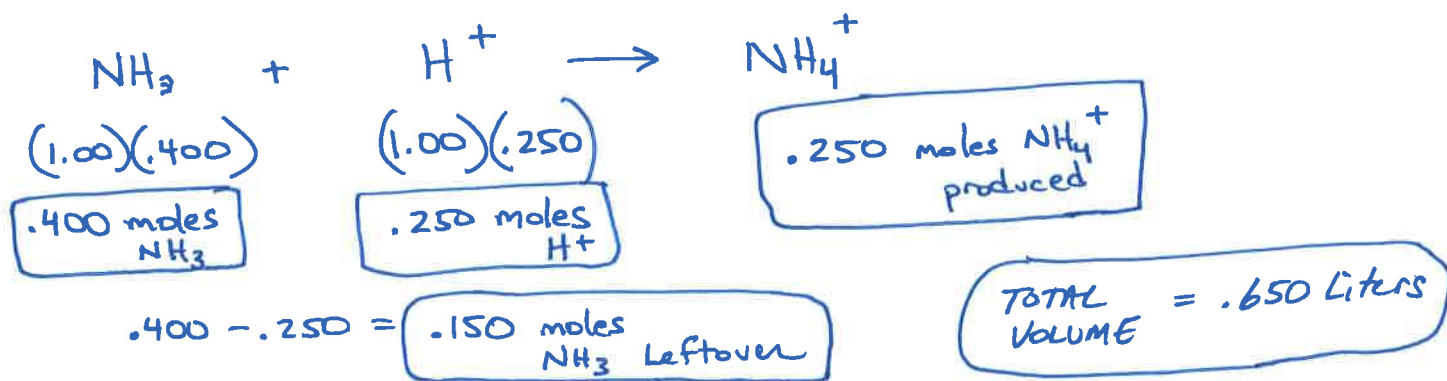
$$K_b = 1.5 \times 10^{-11} = \frac{x^2}{[.067 - x]}$$

$$x = 1.0 \times 10^{-6} \text{ M} = [\text{OH}^-]$$

$$\text{pOH} = 6.00$$

$$\text{pH} = 8.00$$

6. What is the pH of the solution formed if 250. mL of 1.00 M HBr and 400.0 mL of 1.00 M NH₃ are mixed together?



$$K_b = 1.8 \times 10^{-5} = \frac{[.38 + x][x]}{[.23 - x]}$$

$$x = [\text{OH}^-] = 1.1 \times 10^{-5} \text{ M}$$

$$\text{pOH} = 4.96$$

$$\text{pH} = 9.04$$

7. What will be the pH at the **equivalence point** in a titration that involves 540 mL of 0.100 M HCN and 0.200 M KOH?



$$\begin{array}{l} (.100)(.54) \\ \hline .054 \text{ moles HCN} \end{array}$$

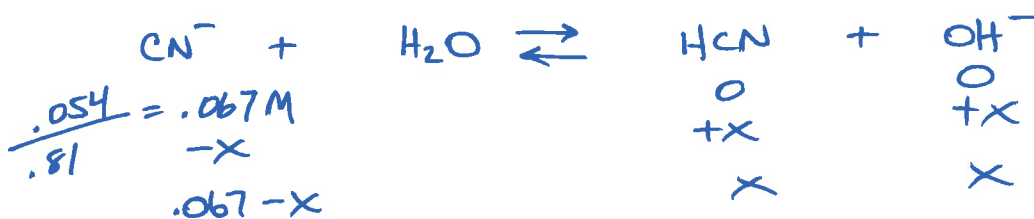
$$= .054 \text{ moles OH}^-$$

.054 moles CN^- produced

$$.054 = (.200)(V)$$

$$V = .27 \text{ Liters KOH needed}$$

TOTAL VOLUME = .81 Liters



$$K_b = 2.0 \times 10^{-5} = \frac{x^2}{[.067 - x]}$$

$$x = [\text{OH}^-] = .0011 \text{ M}$$

$$\text{pOH} = 2.94$$

$$\text{pH} = 11.06$$

8. What is the final pH of the solution if 300. mL of 1.20 M NaOH and 320. mL of 1.00 M $\text{HC}_2\text{H}_3\text{O}_2$ are mixed?



$$(1.00)(.320)$$

$$.320 \text{ moles HC}_2\text{H}_3\text{O}_2$$

$$(1.20)(.300)$$

$$.360 \text{ moles OH}^-$$

EXCESS STRONG!

TOTAL VOLUME = .620 Liters

$$\begin{array}{r} .360 \\ - .320 \\ \hline .040 \text{ moles OH}^- \text{ leftover} \end{array}$$

$$[\text{OH}^-] = \frac{.040}{.620} = .065 \text{ M}$$

$$-\log[.065] = \text{pOH} = 1.19$$

$$\text{pH} = 12.81$$