Determining the pH of the contents in a flask in a titration scenario… (Ignoring any effect of water)

strong acid analyte / strong base titrant

HX + MOH → H_2O + MX (neutral salt)

What's in your dish?	HX	OH-	→	H_2O	X-	pH determined by?
Before titration	√					pH = -log[H+]
During titration, but before equivalence point	√			√	√	Stoichiometry – calculate the remaining [HX], then pH = -log[H+]
At equivalence point				√	√	Only neutral products – pH = 7
After equivalence point		√		√	√	Determine excess [OH-], then pH = 14 - pOH

weak acid analyte / strong base titrant

HA + OH- → H_2O + A- (conjugate base)

What's in your dish?	HA	OH-	→	H_2O	A-	pH determined by?
Before titration	√					K_a problem; $K_a = x^2/[HA]$ pH = -log x
During titration, but before equivalence point	√			√	√	Buffer formation pH = pKa + log[A-]/[HA]
At equivalence point				√	√	Only products: conjugate base and water K_b problem; $K_b = x^2/[A-]$ pOH = -log x pH = 14 - pOH
After equivalence point		√		√	√	Determine excess [OH-], then pH = 14 - pOH

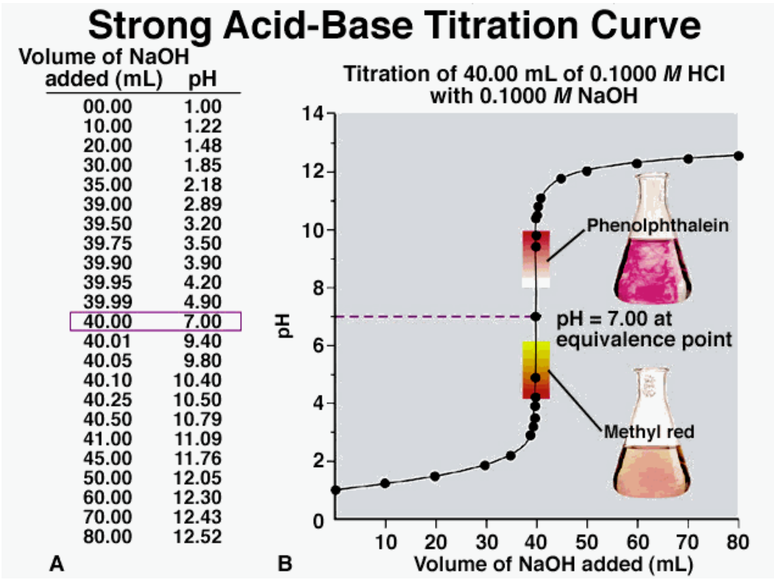
weak base analyte / strong acid titrant

B + HX → X- + HB^+ (conjugate acid)

What's in your dish?	B	HX	→	X-	HB^+	pH determined by?
Before titration	√					K_b problem; $K_b = x^2/[B]$ pOH = -log x pH = 14 - pOH
During titration, but before equivalence point	√			√	√	Buffer formation pH = pKa + log[HB+]/[B]
At equivalence point				√	√	Only products: conjugate acid and water K_a problem; $K_a = x^2/[HB+]$ pH = -log x
After equivalence point		√		√	√	Determine excess [HX], then pH = -log [H+]

Sample Titration Curves

Image source: http://www.chem.ufl.edu/~itl/2045/lectures/lec_z2.html

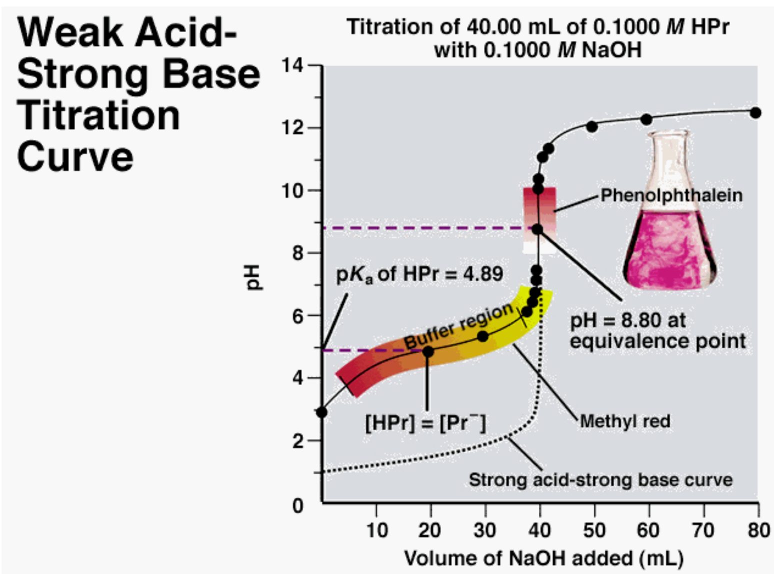


$HCl + NaOH \rightarrow H_2O + NaCl$

Note the following:

1) The pH = 7 at the equivalence point for the titration of a strong acid with a strong base. The only chemicals present at the equivalence point of any titration are PRODUCTS, and the products of this titration are water and a neutral salt.

2) The pH continues to rise past the equivalence point as more base is added to the flask from the burette simply because now the flask contains products and excess base titrant.



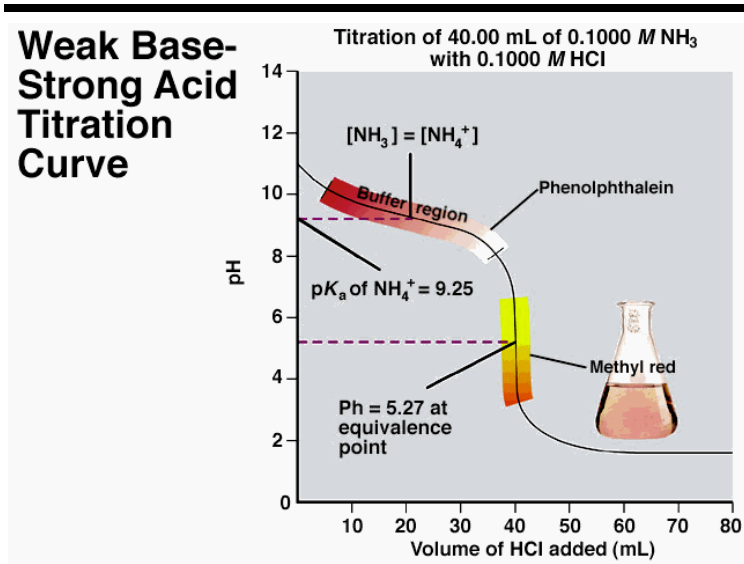
HPr = a weak acid, so Pr- is its conjugate base

Note the following:

1) **The pH > 7 at the equivalence point for the titration of a weak acid with a strong base.** The only chemicals present at the equivalence point of any titration are PRODUCTS, which in this case are water and the **conjugate base** of the weak acid titrated.

2) As the strong base is dripped in, the weak acid reacts and turns into its conjugate base, thus both the weak acid and its conjugate base are both in the same dish at the same time → a **BUFFER is formed**!

3) When exactly ½ of the weak acid is neutralized, [HPr] = [Pr-], so [Pr-]/[HPr] = 1 in the buffer formed and the pH = pKa



NH_3 = a weak base, so NH_4+ is its conjugate acid

Note the following:

1) **The pH < 7 at the equivalence point for the titration of a weak base with a strong acid.** The only chemicals present at the equivalence point of any titration are PRODUCTS, which in this case are water and the **conjugate acid** of the weak base titrated.

2) As the strong acid is dripped in, the weak base reacts and turns into its conjugate acid, thus both the weak base and its conjugate acid are both in the same dish at the same time → a **BUFFER is formed**!