Let's Practice!

titrant RbOH

6. A 30.0 mL sample of 0.215 M hydroiodic acid completely neutralized 21.2 mL of aqueous rubidium hydroxide solution in a titration experiment.

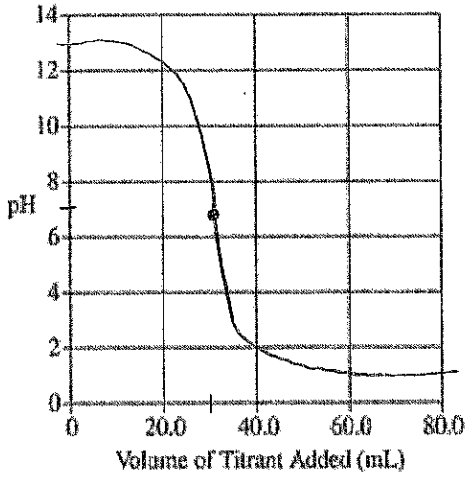
   a. Calculate the molarity of the initial rubidium hydroxide solution.

$M_a V_a = M_b V_b$

$(0.215\ M)(30.0\ mL) = M_b\ (21.2\ mL)$

$M_b = \dfrac{0.215 \times 30.0}{21.2} = \boxed{0.316\ M}$

   b. Sketch the curve that would result from this titration experiment on the grid below.



SB w/ SA!

HA

2. It is found that 24.68 mL of 0.1165 M NaOH is needed to titrate 0.2931 g of a solid, unknown monoprotic acid to the end point. Calculate the molar mass of the acid.

weak

   a. Calculate the moles of unknown acid in your sample.

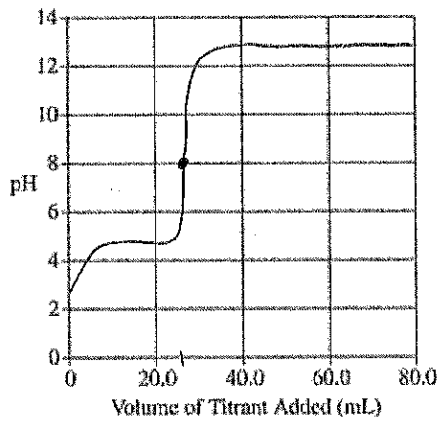
moles acid = mol base (@ eq. pt)

$= M_b V_b = (0.1165\ M)(0.02468\ L) = \boxed{0.002875\ mol\ HA}$

   b. Determine the molar mass of the unknown acid.

$MM(HA) = \dfrac{0.2931\ g}{0.002875\ mol} = \boxed{101.9\ g/mol}$

   c. Sketch the curve that would result from this titration experiment on the grid below.



WA w/ SB

d. The following acid-base indicators are available to follow the titration.

Color Change			
Indicator	**Acid Form**	**Base Form**	**pH Transition Interval**
Bromocresol purple	yellow	purple	5.2 – 6.8
Bromthymol blue	yellow	blue	6.0 – 7.6
Phenolphthalein	clear	pink	8.3 – 10.0

e. Which of them would be most appropriate for signaling the endpoint of the titration?

phenolphthalein

f. Why? B/c a weak acid/strong base titration will have a basic equivalence point, and phenolphthalein is the only available indicator that will change color at a basic pH range.

Multiple Choice Practice: Use the following information to answer questions 7–9.

A student titrates 20.0 mL of 1.0 M NaOH with 2.0 M formic acid, HCO_2H ($K_a = 1.8 \times 10^{-4}$). Formic acid is a monoprotic acid.

7. How much formic acid is necessary to reach the equivalence point?

(b.) 10.0 mL b. 20.0 mL c. 30.0 mL d. 40.0 mL

$M_aV_a = M_bV_b$

$(2.0\ M)V_a = (1.0M)(20.0mL) \Rightarrow V_a = \frac{20}{2} = 10$

8. At the equivalence point, is the solution acidic, basic, or neutral? Why?

a. Acidic; the strong acid dissociates more than the weak base.

(b.) Basic; the only ion present at equilibrium is the conjugate base.

c. Basic; the higher concentration of the base is the determining factor.

d. Neutral; equal moles of both acid and base are present.

9. If the formic acid were replaced with a strong acid such as HCl at the same concentration (2.0 M), how would that change the volume needed to reach the equivalence point?

a. The change would reduce the amount as the acid now fully dissociates.

b. The change would reduce the amount because the base will be more strongly attracted to the acid.

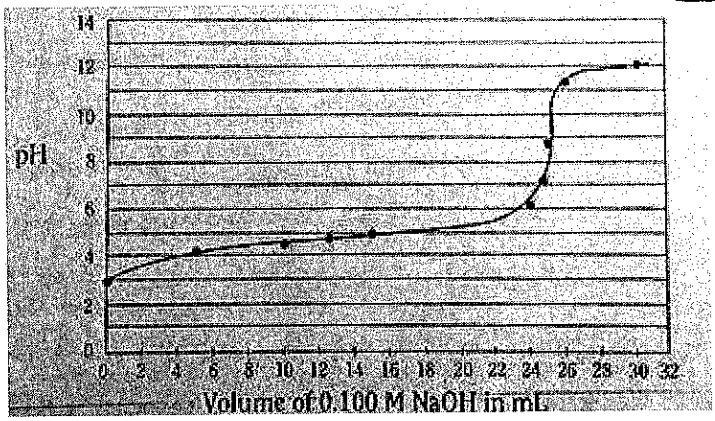
c. The change would increase the amount because the reaction will now go to completion instead of equilibrium.

(d.) Changing the strength of the acid will not change the volume needed to reach equivalence point.

10. Examine the data and titration curve below for the titration of a weak acid with NaOH.

~½ eq. pt ~eq. pt

Volume NaOH added (mL)	0.00	5.00	10.00	12.50	15.00	20.00	24.00	24.90	25.00	26.00	30.00
pH	2.88	4.15	4.58	4.76	4.93	5.36	6.14	7.15	8.73	11.29	11.96



What is the approximate value of the K_a for this acid?

a. 1×10^{-3} (b.) 1×10^{-5} c. 1×10^{-9} d. 1×10^{-11}

$pK_a \approx 4.76 \approx 5 \Rightarrow K_a = 1 \times 10^{-5}$