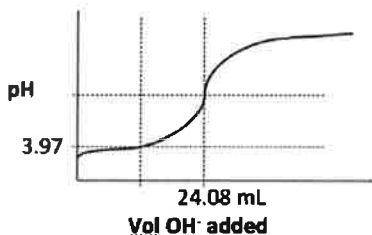


Chapter 16 Number 3 (16.8 – 16.9)

(Unit 3) 28 February 2018

3. This is a continuation of the question asked on worksheet Number 3. The curve represents the titration of 50.00 mL weak acid, HA, with 0.1184 M NaOH.



3h. What is the pH at the equivalence point?

pKa
pKb

100% w/b A^- $n_{A^-} = n_{OH^-} = n_{HA}$ (added orig)

$K_b = 9.3 \times 10^{-11}$ $= n_{OH^-} = M \cdot V = 0.1184 \times 0.02408$
 $= 2.85 \times 10^{-3} \text{ mol}$

$M A^- + H_2O \rightleftharpoons OH^- + HA$ $K_b = \frac{x^2}{[A^-]}$

$x = 1.9 \times 10^{-6}$
 $pOH = 5.72$
 $pH = 8.28$

$\frac{2.85 \times 10^{-3} \text{ mol}}{0.07408 \text{ L}} = 0.0385 \text{ M}$

ICE

3i. What is the pH after 30.00 mL NaOH(aq) have been added? *n ICE problem*

Excess OH^- (past equiv pt)

$n HA + OH^- \rightarrow H_2O + A^-$

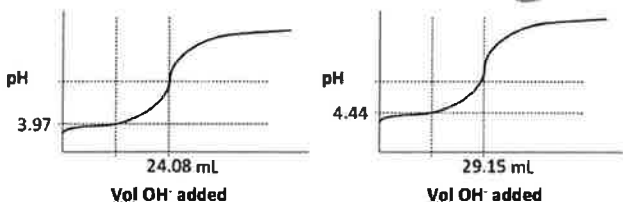
I	.00285	.003552
C	-.00285	-.00285
E	~0	.000702

$[OH^-] = \frac{.000702}{.0802} = 8.78 \times 10^{-3} \text{ M}$

$n_{HA} = 2.85 \times 10^{-3} \text{ mol}$ **pH = 11.94**

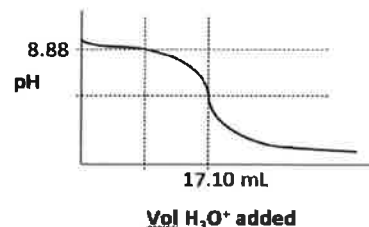
$n_{OH^-} = 0.1184 \text{ mol/L} \times 0.0300 \text{ L} = 0.003552 \text{ mol}$

4a. Which acid is the stronger weak acid, HA, shown at left or HB, shown at right? Both acids were titrated with 0.100 M NaOH(aq). Circle HA or HB



4b. Which acid is the more concentrated weak acid, HA or HB? Both acids were titrated with 0.100 M NaOH(aq). Circle HA or HB

5a. What is being titrated here?
 Example: "Strong acid with strong base." The second item listed is in the buret.



Weak base with H_3O^+

5b. What is the significance of pH = 8.88? Could it be used to determine pK_b ? If so, do it.

It is pK_a and
 $pK_a + pK_b = 14$

6. What volume of $5.00 \times 10^{-3} \text{ M HNO}_3$ is needed to titrate 100.00 mL of $5.00 \times 10^{-3} \text{ M Ca(OH)}_2$ to the equivalence point?

- A. 12.5 mL
 B. 50.0 mL
 C. 100. mL
 D. 200. mL

$\rightarrow 2 OH^-$
 $n_{OH^-} = 1 \times 10^{-3}$

7. What is the pH of a solution made by mixing 30.00 mL of 0.10 M HCl with 40.00 mL of 0.10 M KOH? Assume that the volumes of the solutions are additive.

- A. 0.85
 B. 1.85
 C. 12.15
 D. 13.15

$n_{H_3O^+} = 0.00300 \text{ mol}$
 $n_{OH^-} = 0.00400 \text{ mol}$
 $[OH^-] = \frac{0.00100 \text{ mol}}{.0702}$

8. What is the pH at the equivalence point of a weak acid-strong base titration?

- A. pH < 7
 B. pH = 7
 C. pH > 7
 D. pH = 14.00

9. What is the approximate pH at the equivalence point of a weak acid-strong base titration if 25 mL of aqueous formic acid requires 29.80 mL of 0.0567 M NaOH? $K_a = 1.8 \times 10^{-4}$ for formic acid.

- A. 2.46
 B. 5.88
 C. 8.12
 D. 11.54

C is the only reasonable choice, I did not do calc.

Now try these problems from the book:
 Section 16.8 – 16.9. Problems 18 – 19, 90, and 96