Lecture 7

Titrations II

Lecture Question 1 – p 105a

Consider the following 5 titrations:

I. 50.0 mL of 0.1 M $HONH_2$ ($K_b \approx 1 \times 10^{-8}$) by 0.20 M HBr
II. 50.0 mL of 0.1 M HOC_6H_5 ($K_a \approx 1 \times 10^{-10}$) by 0.20 M KOH
III. 50.0 mL of 0.1 M $Ca(OH)_2$ by 0.20 M HBr
IV. 50.0 mL of 0.1 M $(C_2H_5)_2NH$ ($K_b \approx 1 \times 10^{-3}$) by 0.20 M HBr
V. 50.0 mL of 0.1 M HNO_3 by 0.20 M KOH

Rank these titrations in order of increasing pH at the halfway point to equivalence.

a. V<I<II<IV<III b. V<IV<I<II<III c. V<II<I<IV<III d. V<II<IV<I<III

Lecture Question 2 – p 105a

Consider the following 4 titrations:

I. 50.0 mL of 0.1 M $HONH_2$ ($K_b \approx 1 \times 10^{-8}$) by 0.20 M HBr
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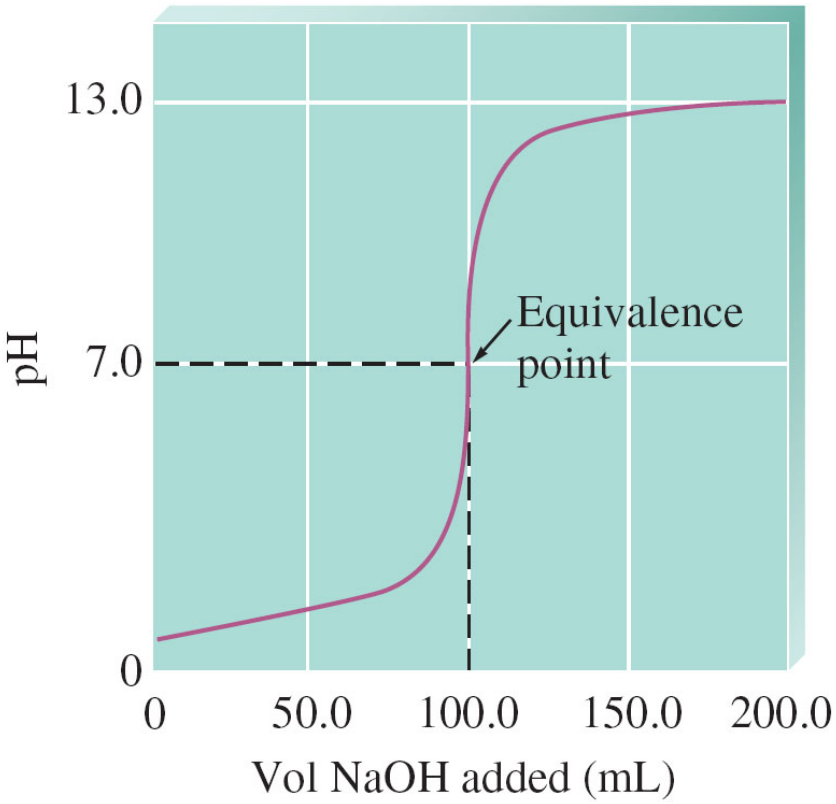
Rank these titrations in order of increasing pH at the equivalence point.

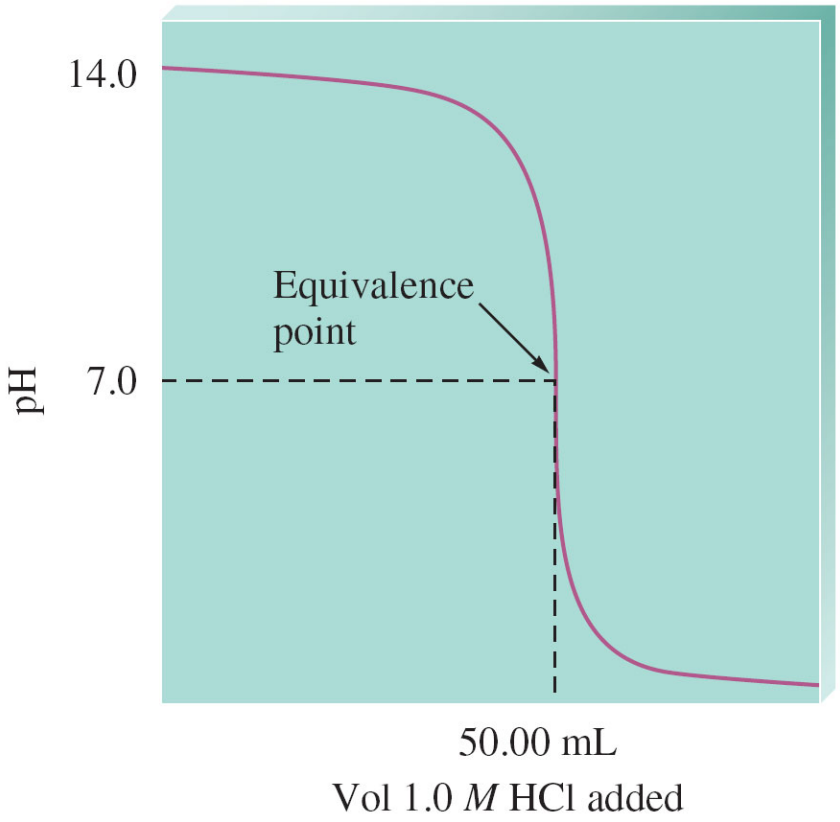
a. I<IV<III<II b. IV<I<III<II c. III<II<IV<I d. II<III<I<IV

Titration (pH) Curve – a plot of pH of solution vs. volume of titrant added

pH curve for a strong acid titrated by strong base

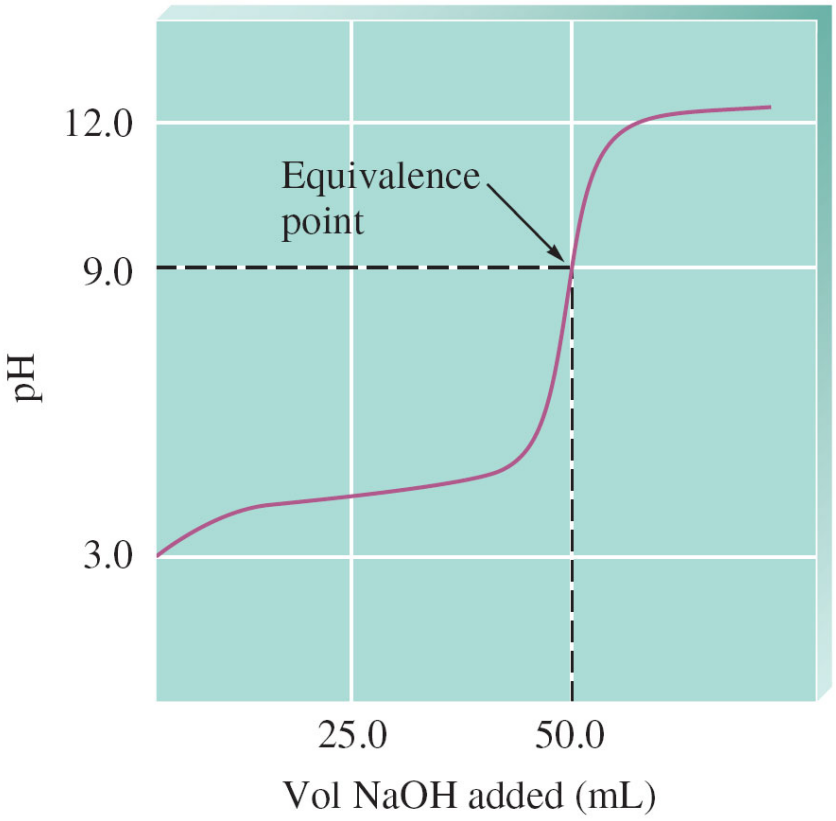


pH curve for a strong base titrated by strong acid



More Titration (pH) Curves

pH curve for a weak acid titrated by strong base



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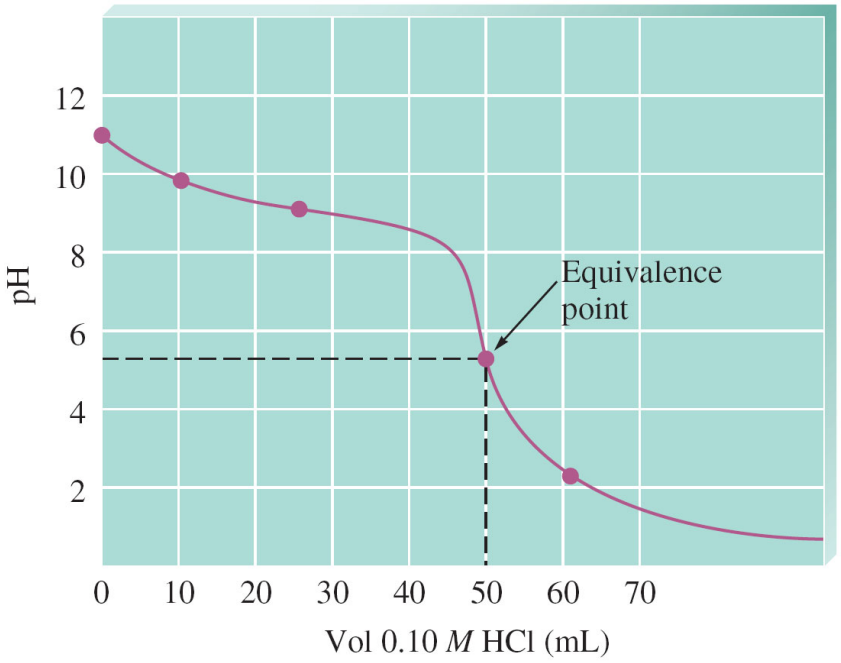

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Lecture Question 2 – p 105a

Consider the following 4 titrations:

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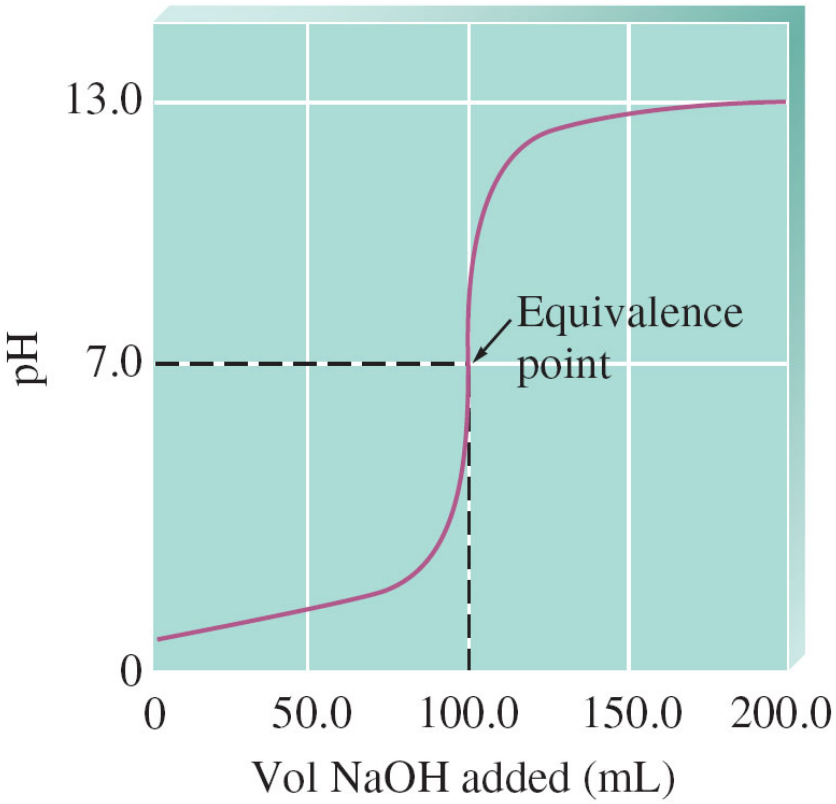
Titration (pH) Curve – a plot of pH of solution vs. volume of titrant added

pH curve for a strong acid titrated by strong base



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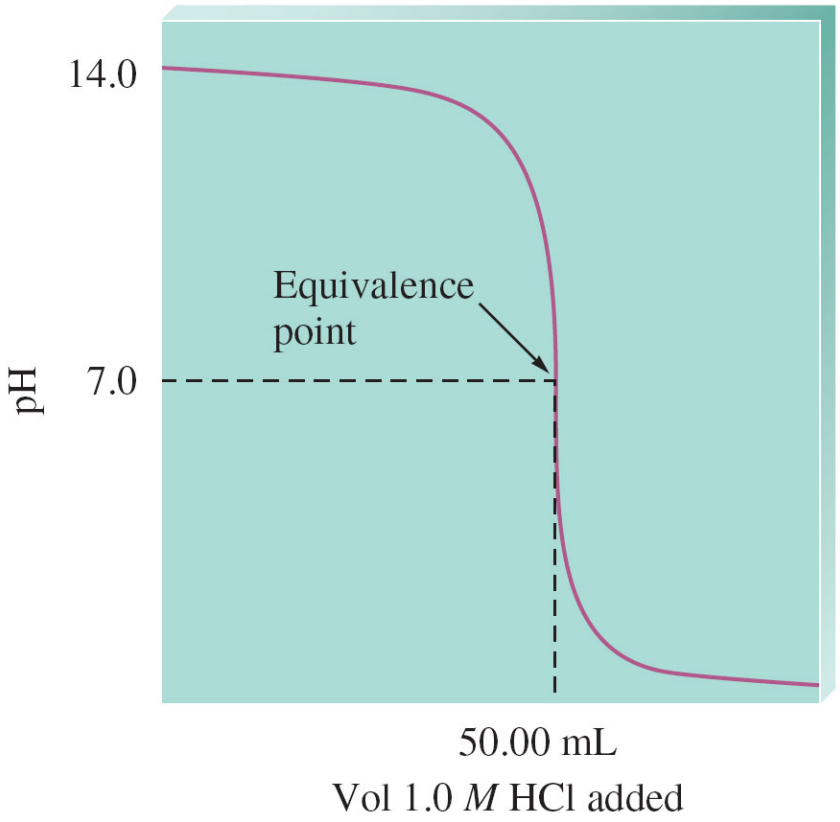

More Titration (pH) Curves

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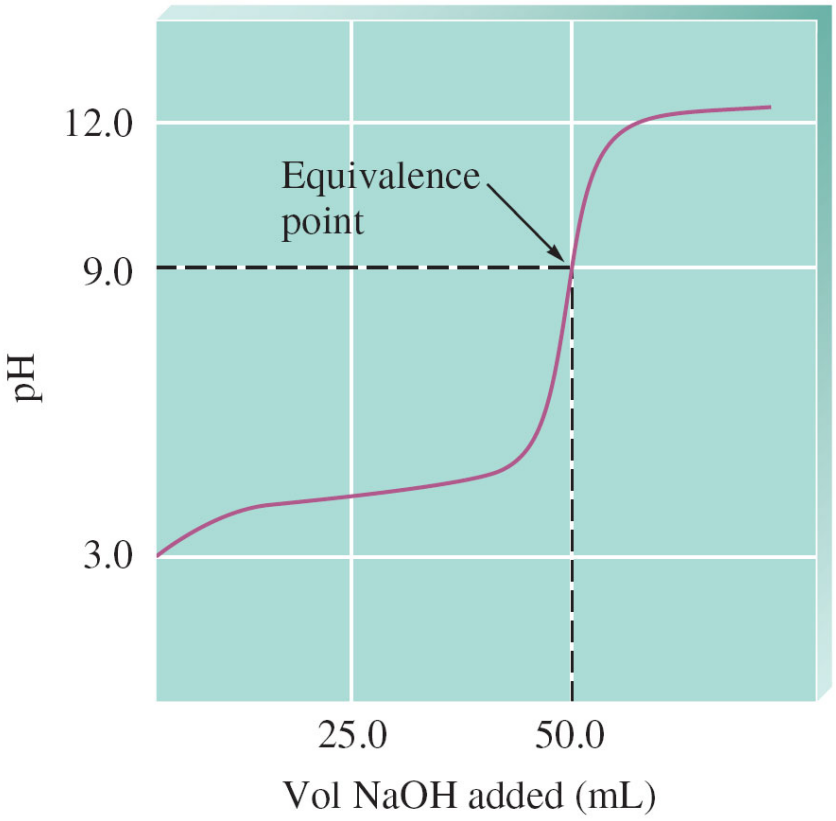

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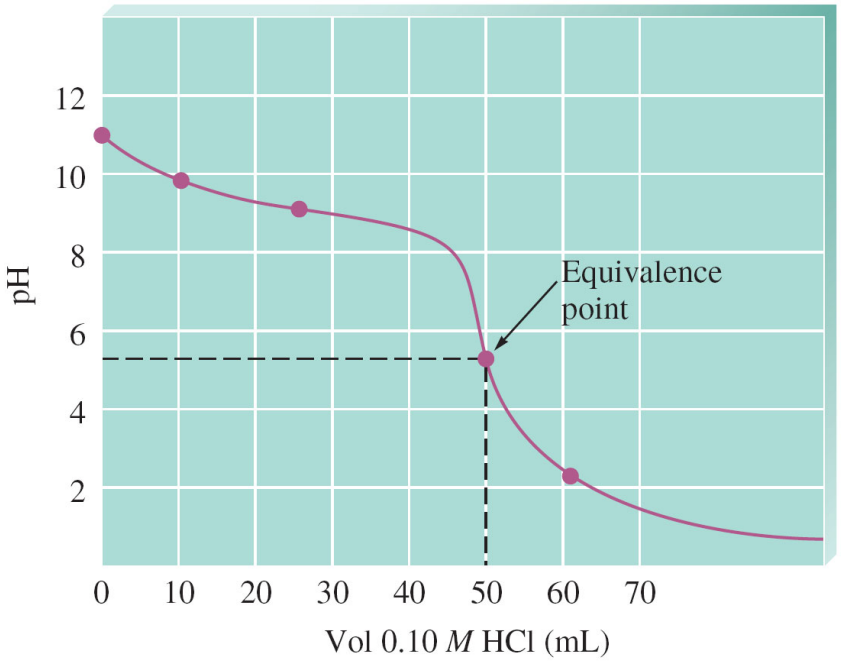
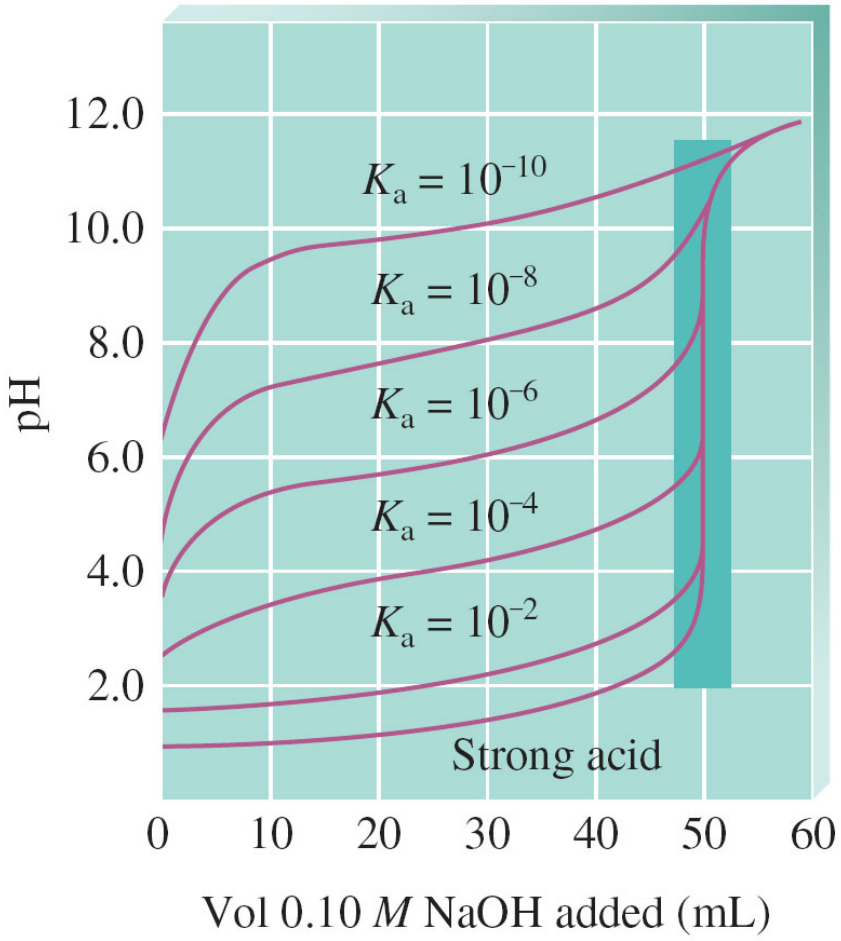


Multiple Acid Titration (pH) Curves



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Lecture Question 2

Consider the following 4 titrations:

I. 50.0 mL of 0.1 M $HONH_2$ ($K_b \approx 1 \times 10^{-8}$) by 0.20 M HBr
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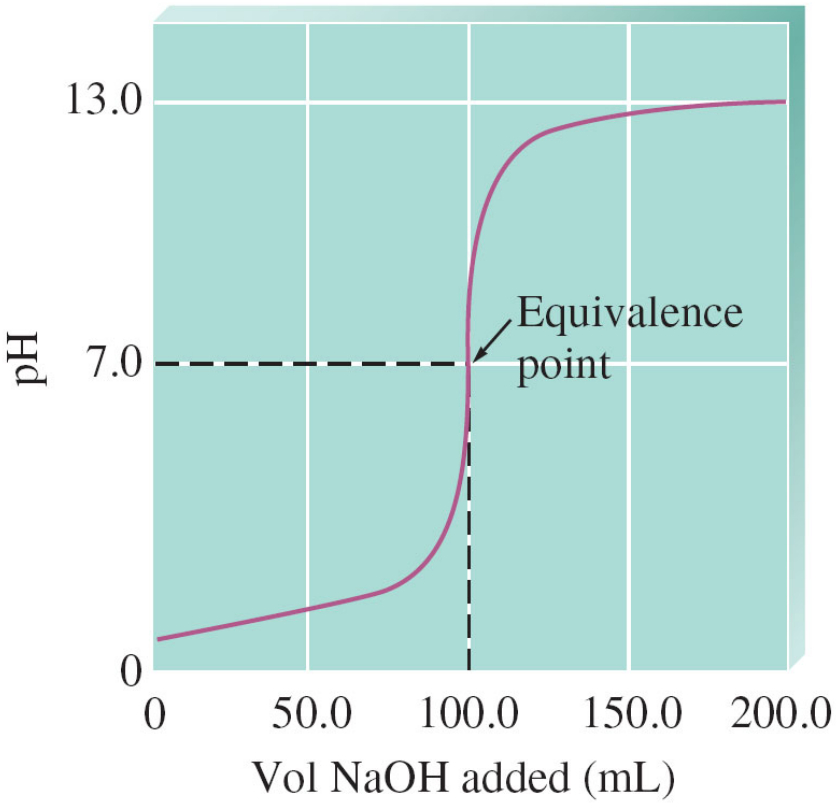

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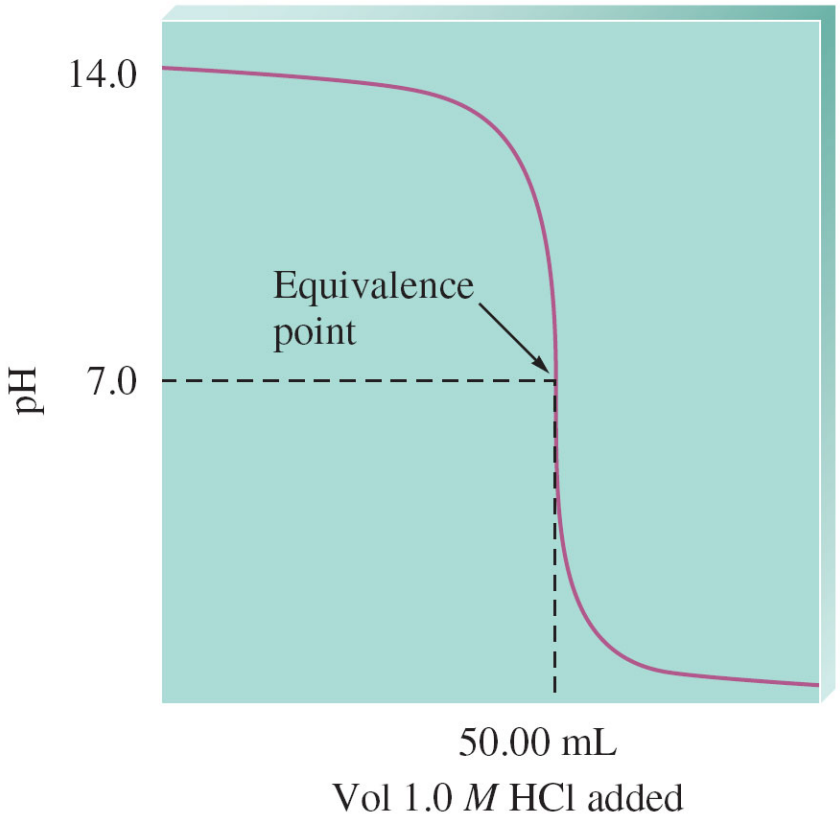

More Titration (pH) Curves

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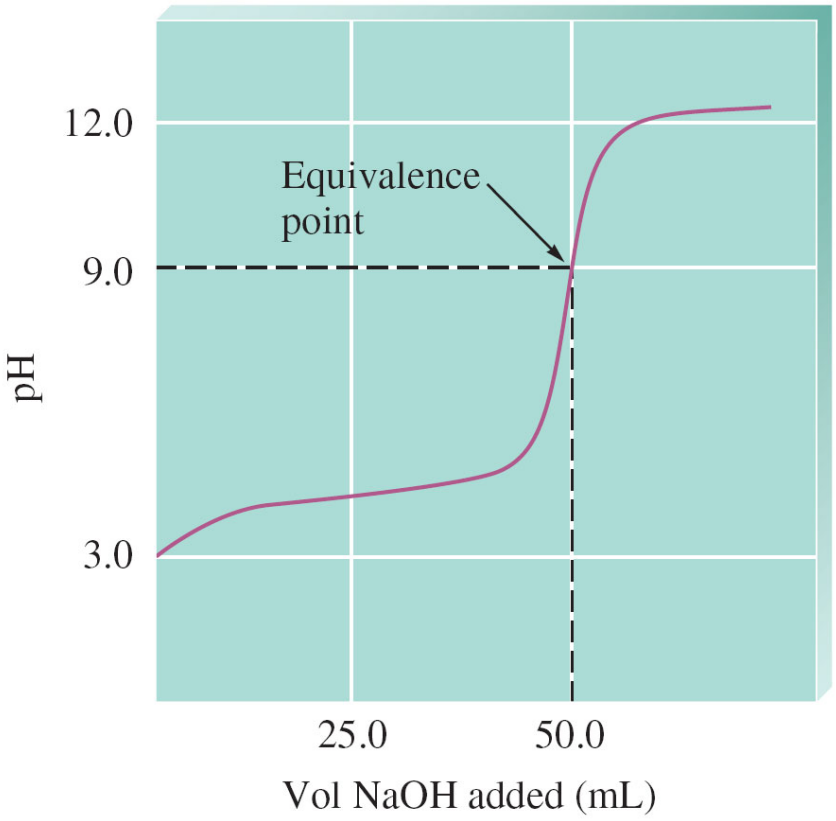

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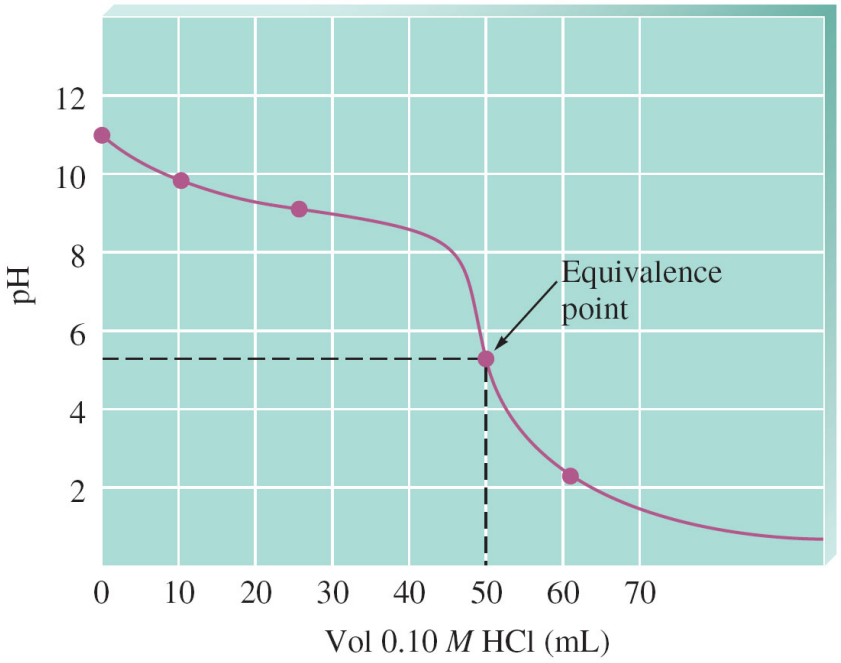

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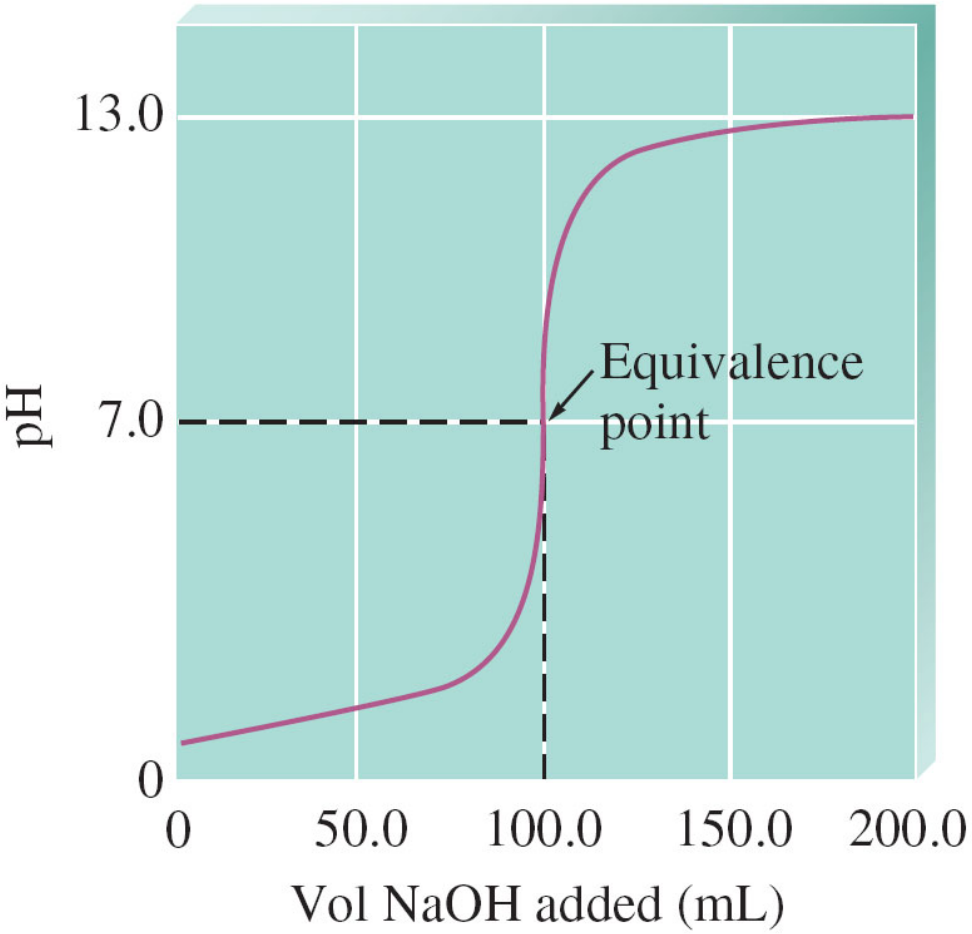
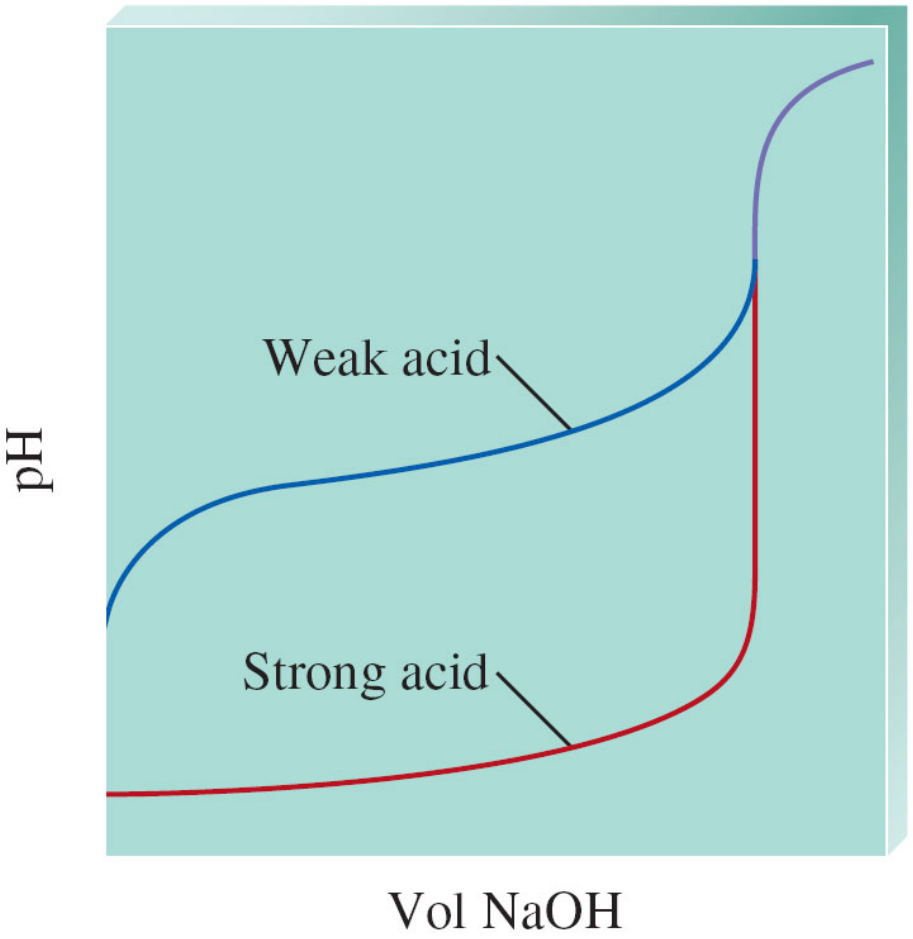
Strong Acid – Strong Base Titrations



Weak Acid vs. Strong Acid Titration

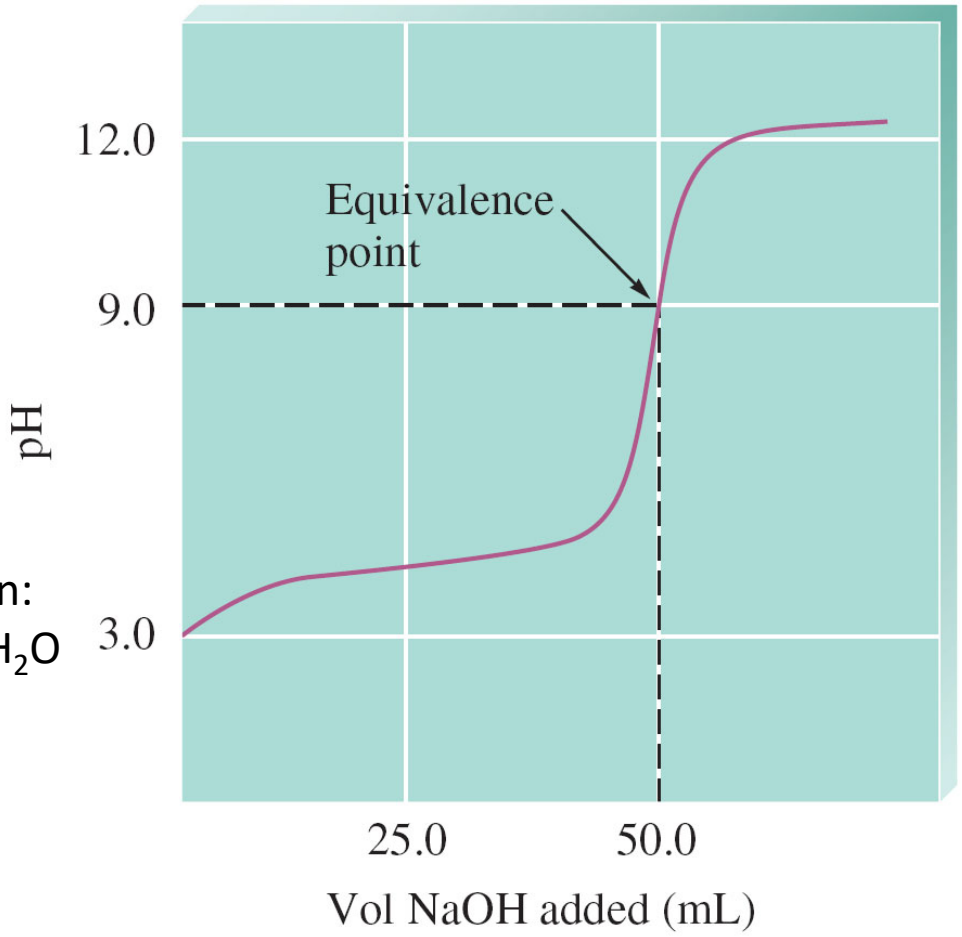


Weak Acid-Strong Base Titrations

100.0 mL of 0.50 M HF titrated by 1.0 M NaOH

Neutralization rxn:

$HF + OH^- \rightarrow F^- + H_2O$



Clicker Question

Consider the following two titrations:

I. 50.0 mL of 0.1 M HCO_2H ($K_a \approx 1 \times 10^{-4}$) by 0.20 M KOH

II. 50.0 mL of 0.1 M HOC_6H_5 ($K_a \approx 1 \times 10^{-10}$) by 0.20 M KOH

III. 50.0 mL of 0.1 M HNO_3 by 0.20 M KOH

Which of the following statements is false?

a. The HNO_3 titration has a lower pH initially before the titration begins as compared to the other titrations.

b. At 12.5 mL KOH added, the HCO_2H titration has pH ≈ 4.0.

c. At the halfway point to equivalence for the HOC_6H_5 titration, the pH is acidic.

d. The pH of the HOC_6H_5 titration has a higher pH at the equivalence point as compared to the HCO_2H titration.

e. The pH of the HNO_3 titration is 7.0 at 25.0 mL KOH added.

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c. At the halfway point to equivalence for the HOC_6H_5 titration, the pH is acidic.

d. The pH of the HOC_6H_5 titration has a higher pH at the equivalence point as compared to the HCO_2H titration.

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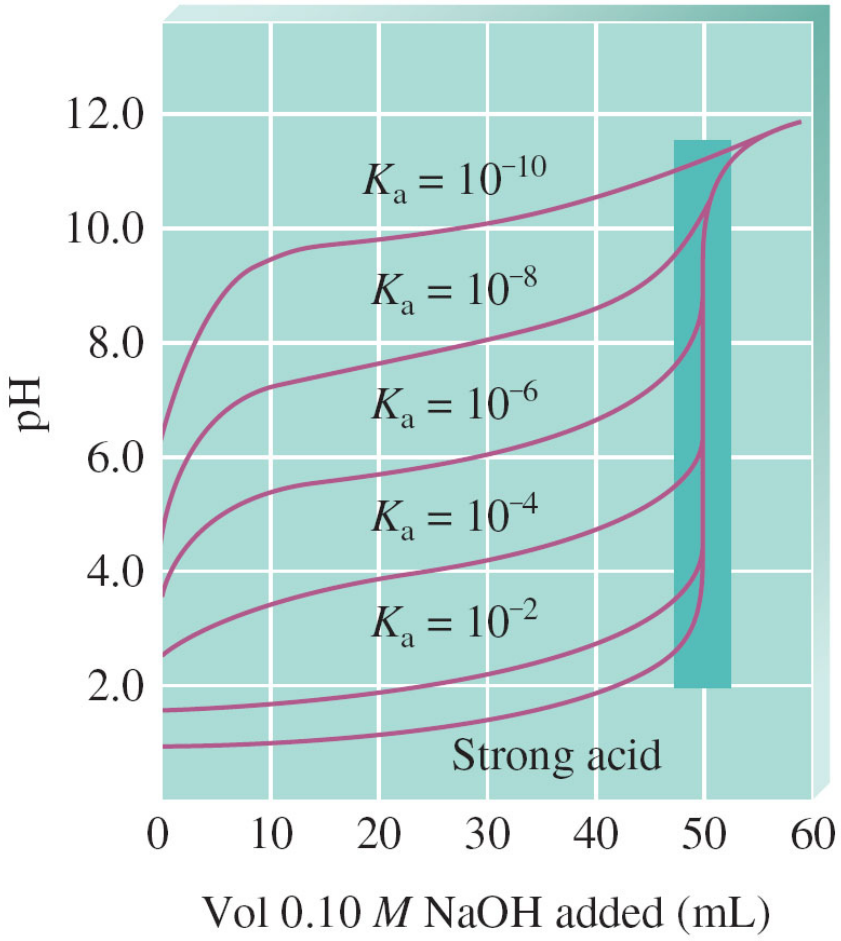
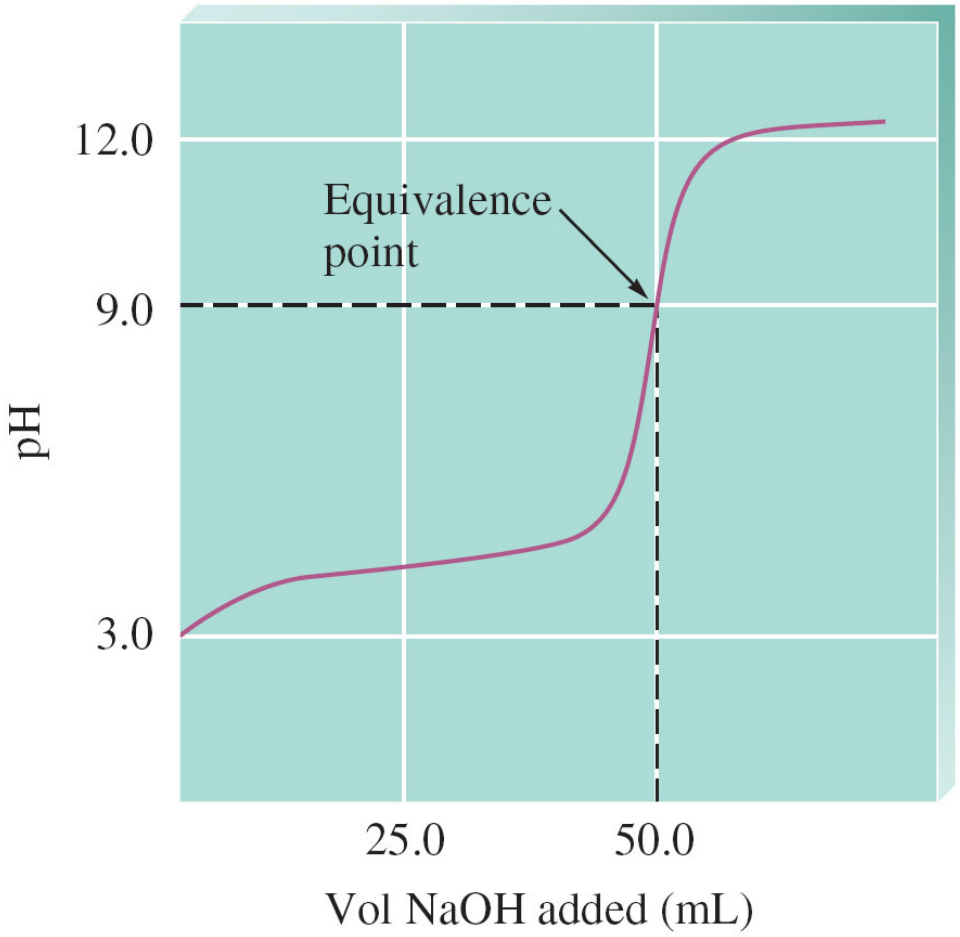
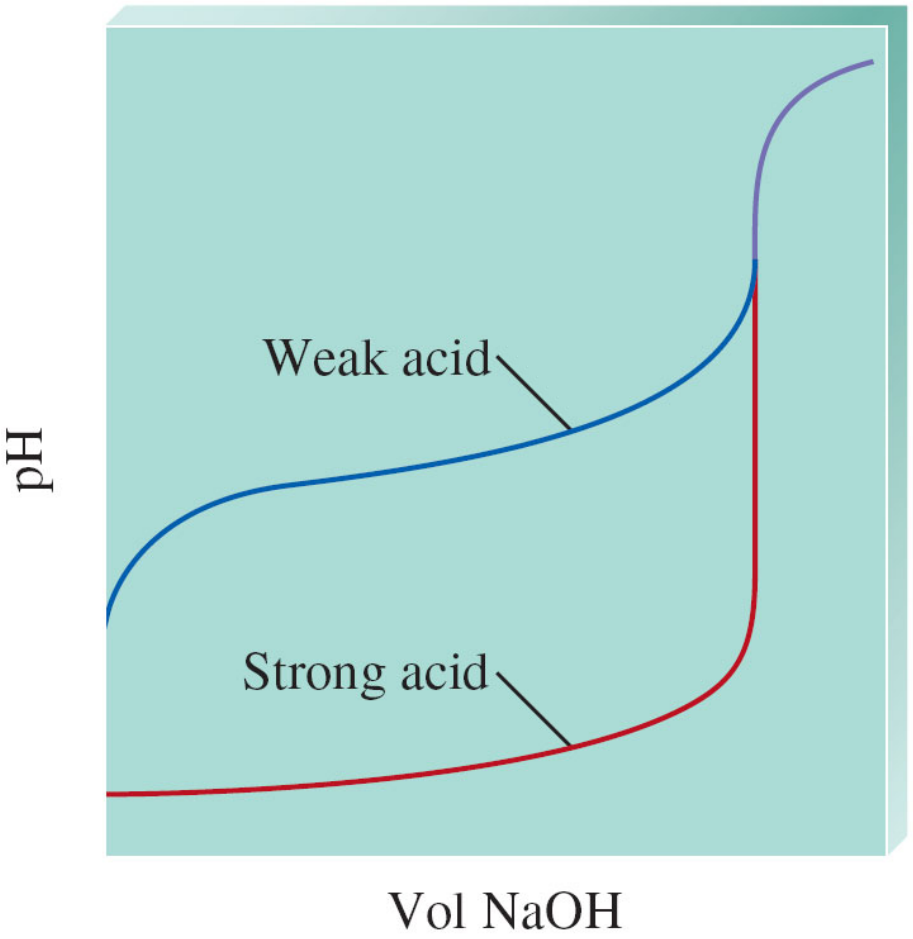
Multiple Acid Titration (pH) Curves



Weak Acid-Strong Base Titrations



Weak Acid vs. Strong Acid Titration



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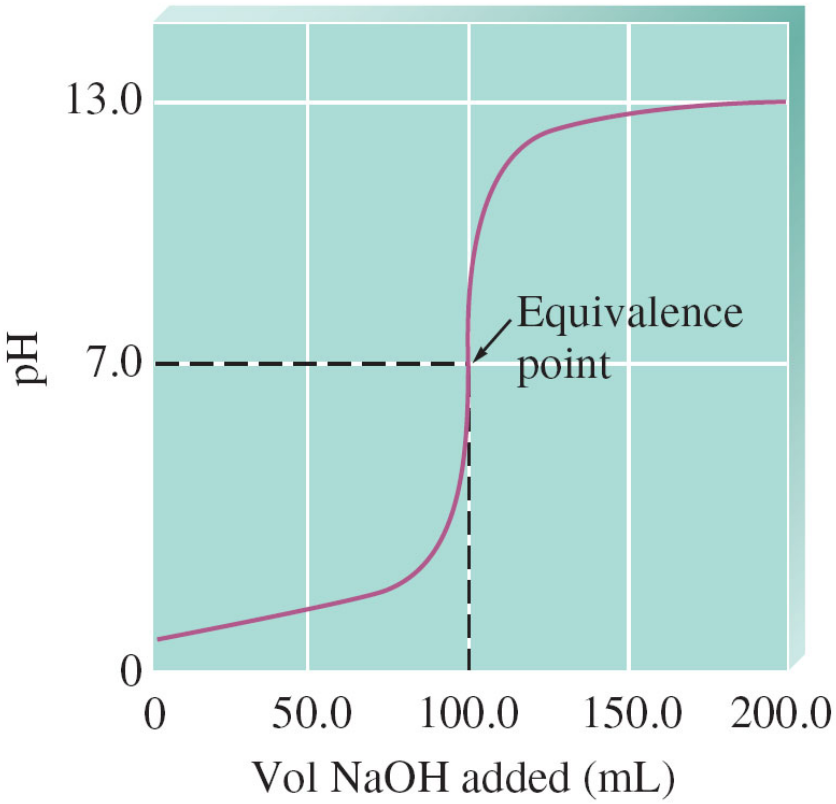

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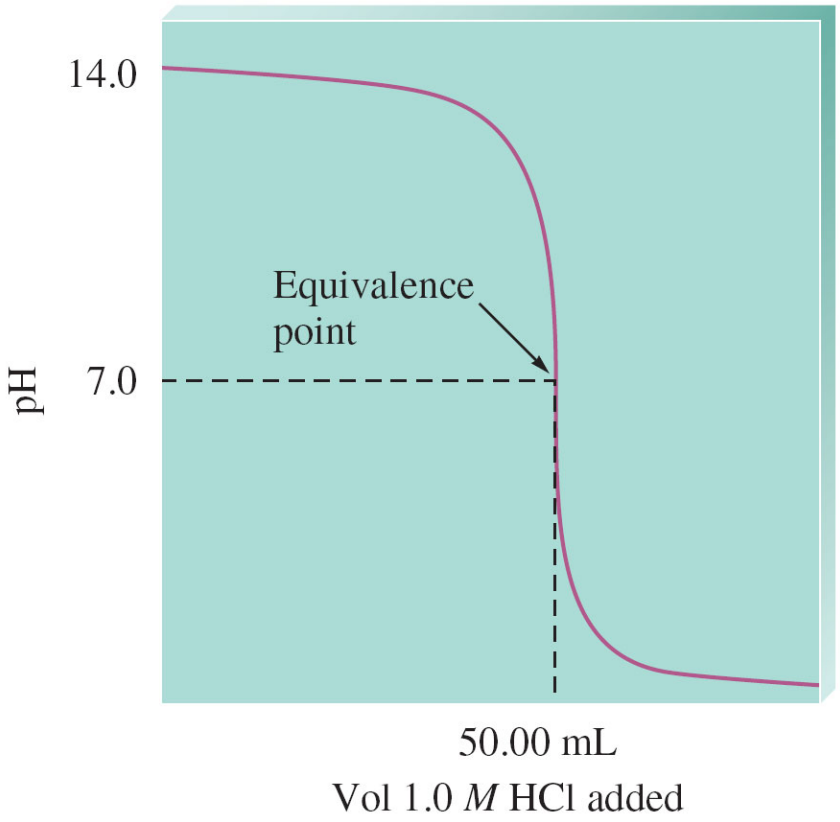
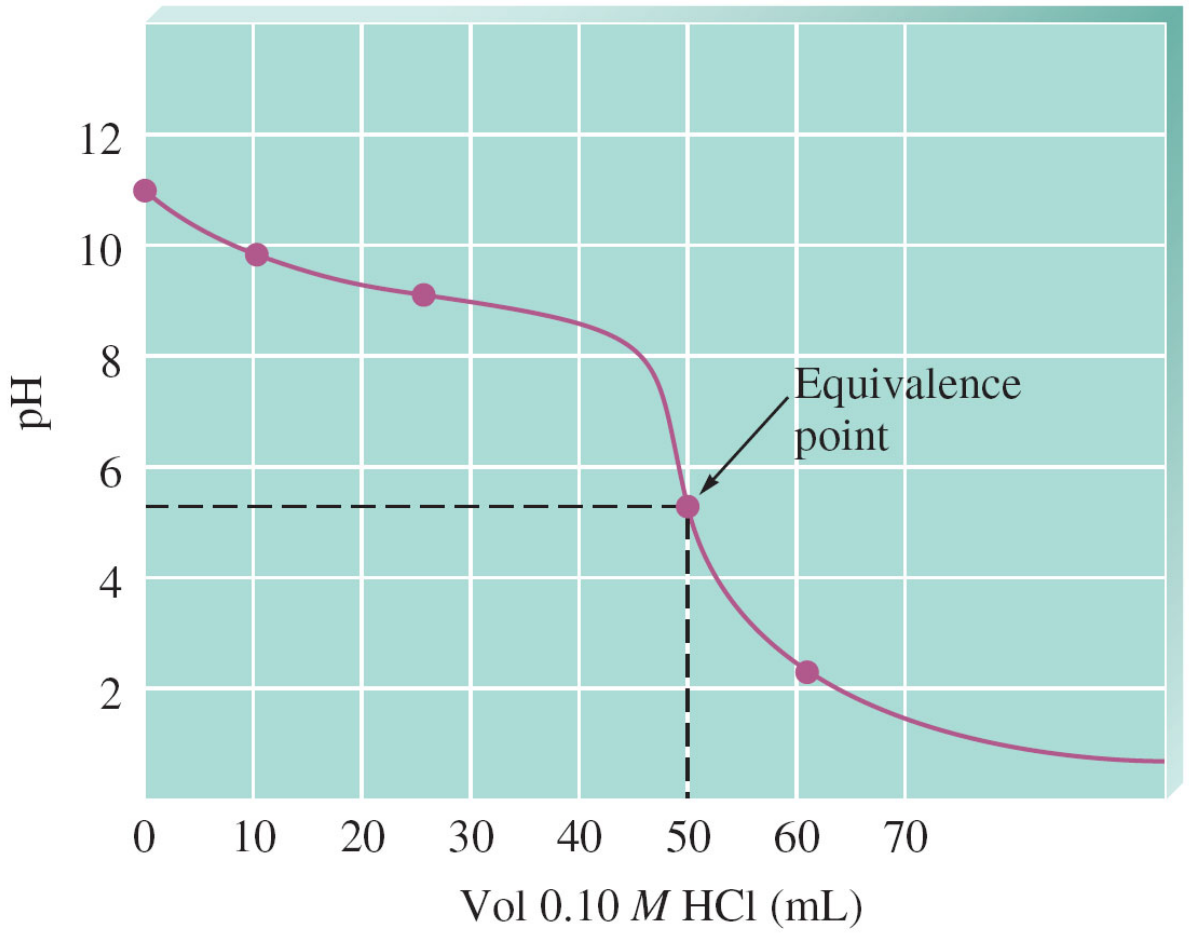


Weak Base – Strong Acid Titration



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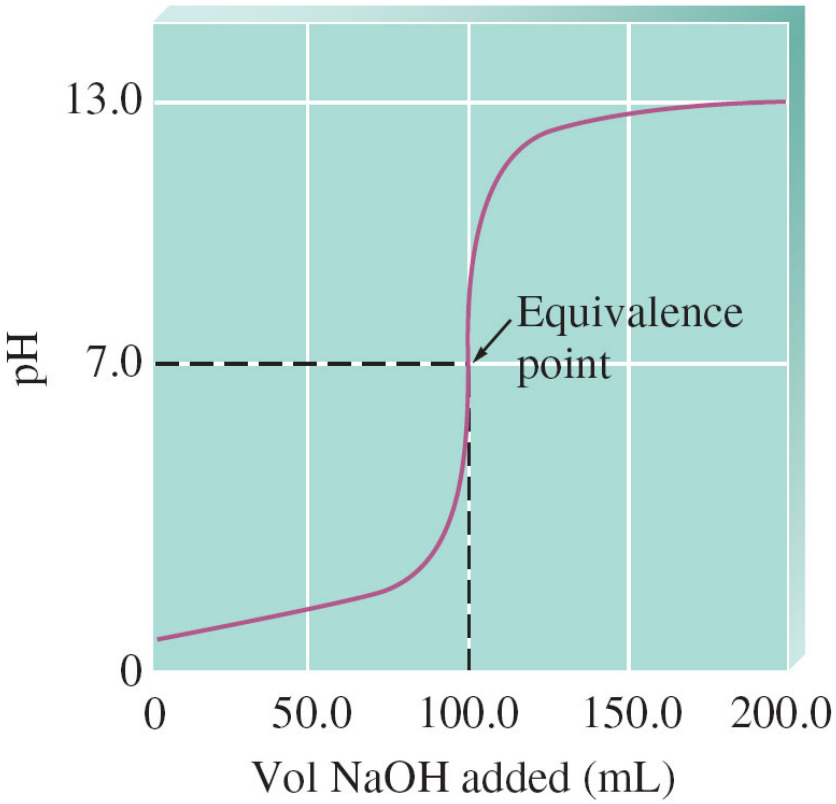

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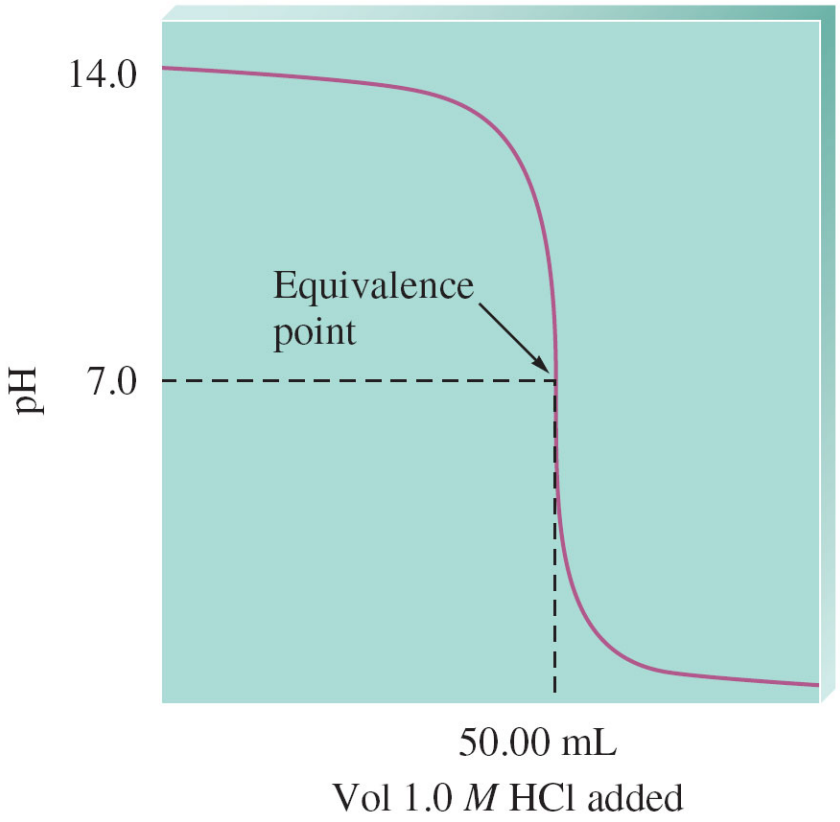

More Titration (pH) Curves

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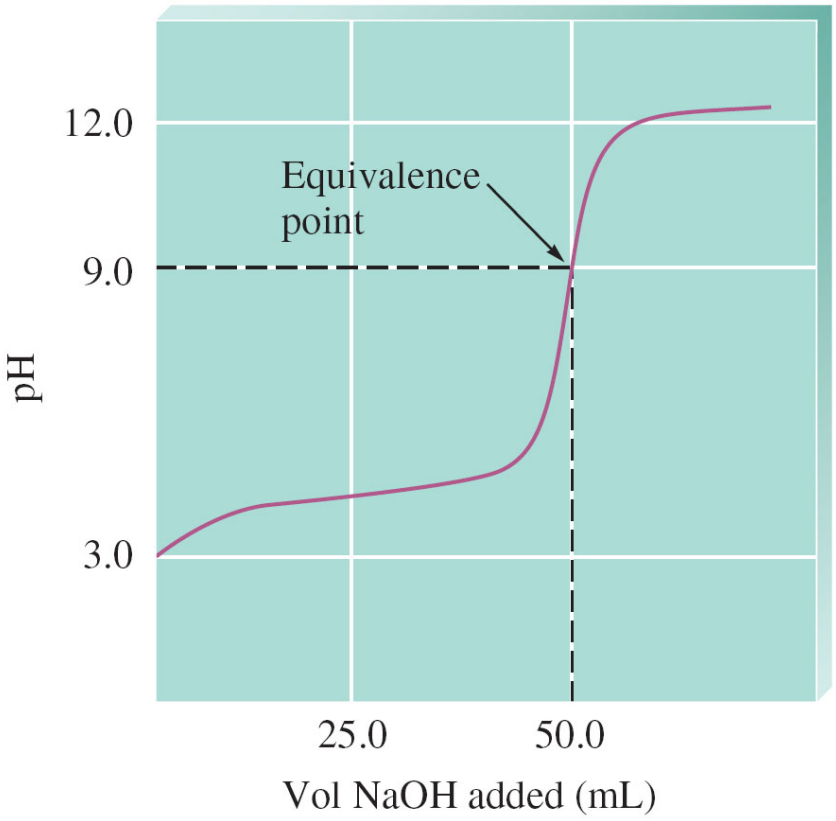

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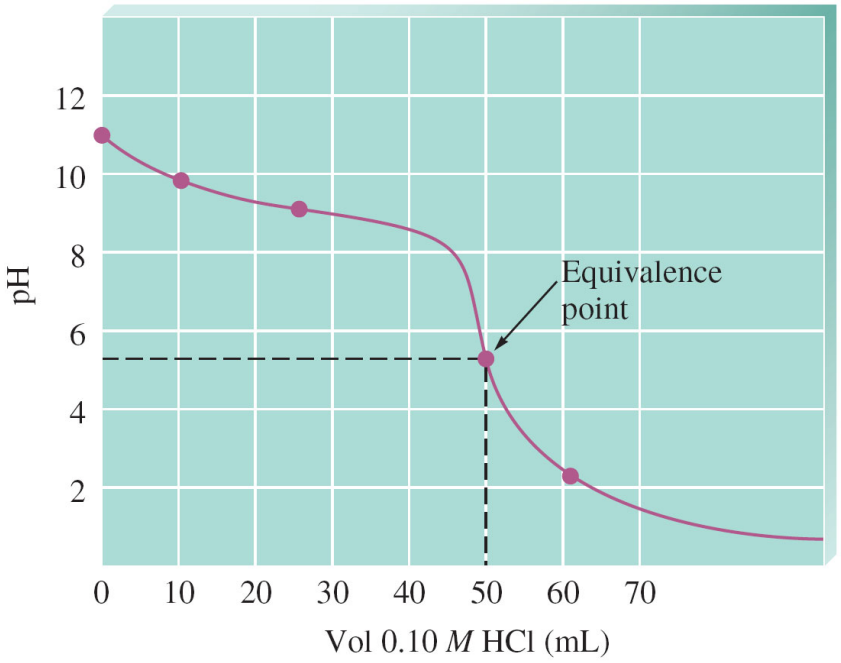

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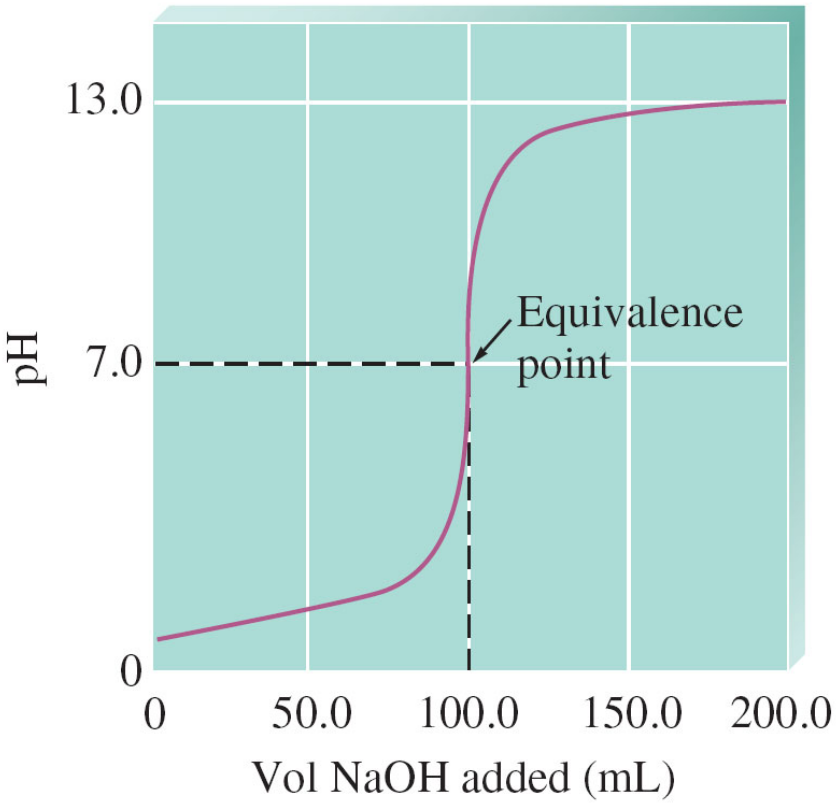
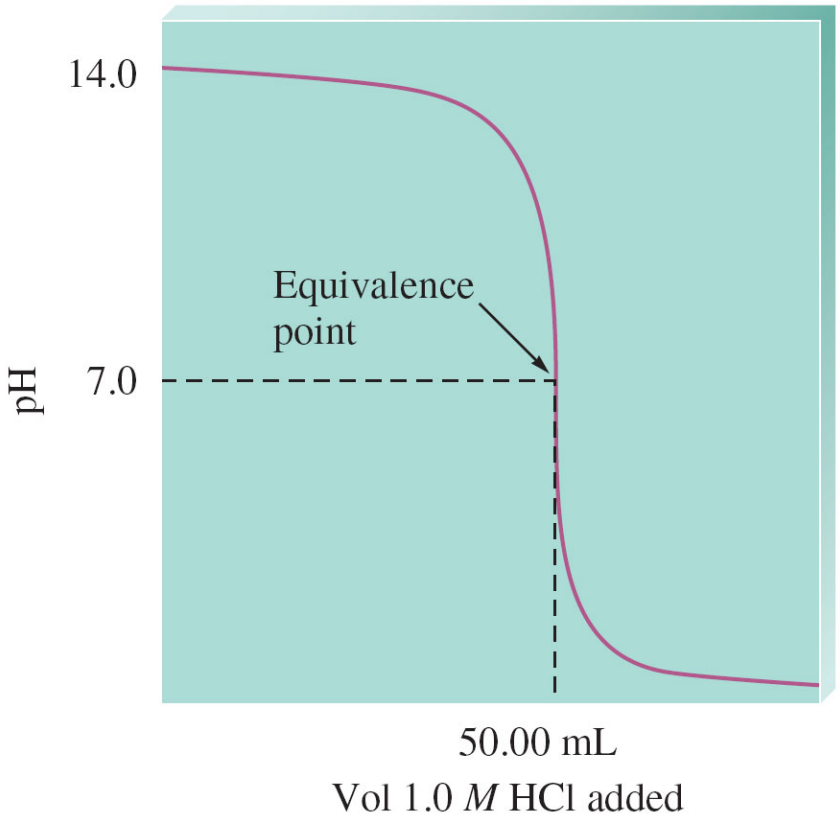
Titration (pH) Curve – a plot of pH of solution vs. volume of titrant added

pH curve for a strong acid titrated by strong base

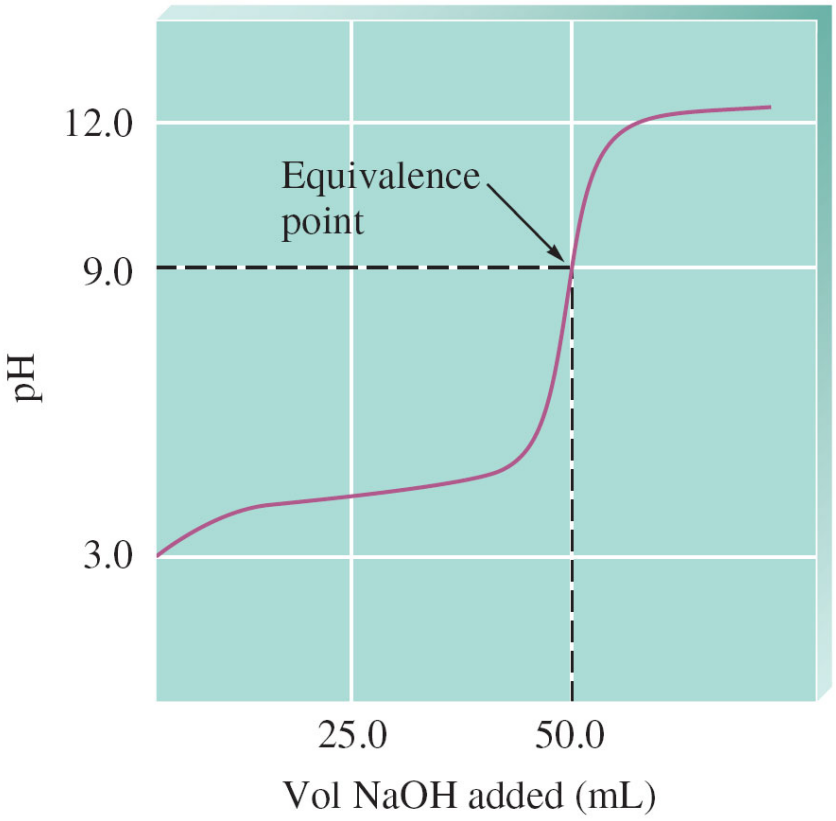


pH curve for a strong base titrated by strong acid

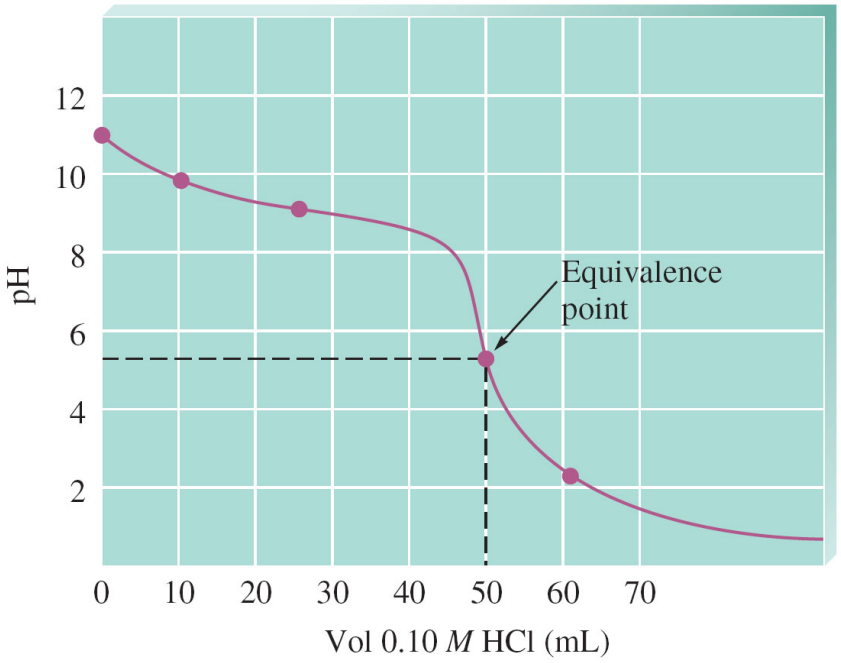


More Titration (pH) Curves

pH curve for a weak acid titrated by strong base



pH curve for weak base titrated by strong acid



Clicker Question

Consider the following 4 titrations:

I. 50.0 mL of 0.1 M $HONH_2$ ($K_b \approx 1 \times 10^{-8}$) by 0.20 M HBr
II. 50.0 mL of 0.1 M HOC_6H_5 ($K_a \approx 1 \times 10^{-10}$) by 0.20 M KOH
III. 50.0 mL of 0.1 M $Ca(OH)_2$ by 0.20 M HBr
IV. 50.0 mL of 0.1 M $(C_2H_5)_2NH$ ($K_b \approx 1 \times 10^{-3}$) by 0.20 M HBr

Rank these titrations in order of increasing pH at the equivalence point.

a. I<IV<III<II b. IV<I<III<II c. III<II<IV<I d. II<III<I<IV

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