AP Chemistry
Chapter 16 Review Game

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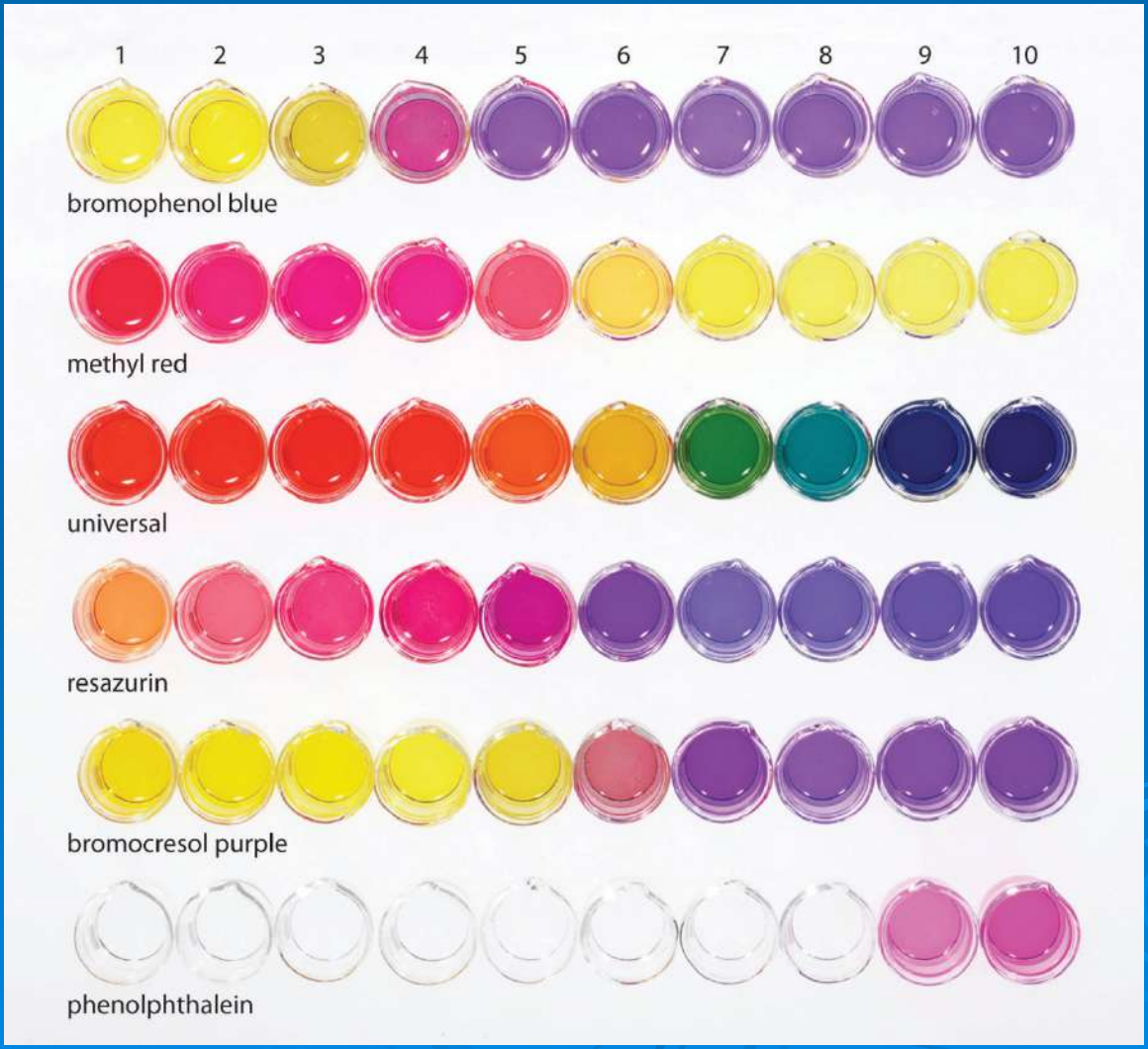
Round 1 – Chapter 16



Surprise	More Surprise	Free Response (Must do all 5)
100	100	100
200	200	200
300	300	300
400	400	400
500	500	500

Surprise 100

A 0.01 M solution of a weak monoprotic acid has a pH equal to 4.0. The ionization constant, K_a, of the acid is

a. 1×10^{-3}

b. 1×10^{-4}

c. 1×10^{-7}

d. 1×10^{-8}

e. 1×10^{-9}

c

Surprise 200

The acid ionization constant, K_a, for propanoic acid, C_2H_5COOH, is 1.3×10^{-5}. Calculate the hydrogen ion concentration, $[H^+]$, in a 0.2M solution of propanoic acid.

$1.61 \times 10^{-3}M$

Surprise 300

On the basis of the information below, what is the approximate percent ionization of HNO_2 in a 1.0 M $HNO_{2(aq)}$ solution?

$HNO_{2(aq)} \leftrightarrows H^+_{(aq)} + NO_2^-{}_{(aq)}$ $K_a = 4.5 \times 10^{-4}$

a.0.00045%

b.0.021%

c.0.045%

d.2.1%

d

Surprise 400

Methylamine, CH_3NH_2, is a weak base that reacts according to the equation below. The value of the ionization constant, K_b, is 5.25×10^{-4}. Methylamine forms salts such as methylammonium nitrate, $CH_3NH_3^+NO_3^-$. Calculate the pH of a solution made by adding 0.01 mol of solid methylammonium nitrate to 120mL of a 0.225M solution of methylamine. Assume that no volume change occurs.

$$CH_3NH_2 + H_2O \leftrightarrow CH_3NH_3^+ + OH^-$$

11.15

Surprise 500

Tartaric acid, $H_2C_4H_4O_6$, has the following K_a values: $K_{a1} = 1 \times 10^{-3}$ and $K_{a2} = 4.6 \times 10^{-5}$. Which ion is present in the lowest concentration?

$C_4H_4O_6^{2-}$

More Surprise 100

For the following reaction the K is greater than 1. Compare the strengths of the acid vs. the conjugate acid and the base vs. the conjugate base.

$HSO_4^- + CO_3^{2-} \leftrightarrows SO_4^{2-} + HCO_3^-$

HSO_4^- is a stronger acid than HCO_3^-.
CO_3^{2-} is a stronger base than SO_4^{2-}.

More Surprise 200

Predict whether a $KHSO_4$ solution is acidic, basic, or neutral and write the reaction that occurs with water.

$HSO_4^- + H_2O \leftrightarrow H_3O^+ + SO_4^{2-}$

acidic

More Surprise 300

The acid dissociation constant for hypochlorous acid (HClO) is 3.0×10^{-8}. Calculate the $[H^+]$ of a 0.009M solution.

1.64×10^{-5}M

More Surprise 400

Explain the following 3 observations:

1. HCl is a stronger acid than H_2S.
2. H_3PO_4 is a stronger acid than H_3AsO_4.
3. $HBrO_3$ is a stronger acid than $HBrO_2$.

1. HCl is more polar because Cl is more electronegative.
2. P is more electronegative than As.
3. $HBrO_3$ has more oxygen atoms than $HBrO_2$.

More Surprise 500

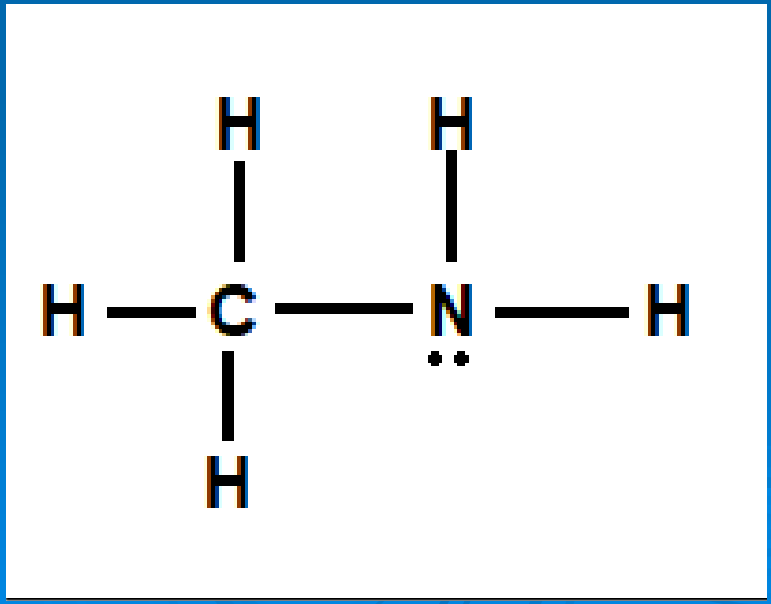
Designate the following compounds as acid, conjugate acid, base, and conjugate base.

$HSO_4^- + HCO_3^- \leftrightarrow SO_4^{2-} + H_2CO_3$

acid **base** **conj. base** **conj. acid**

Free Response 100

Methylamine is a weak base with the formula CH_3NH_2. Complete the Lewis electron-dot diagram for a molecule of methylamine. Show all bonding and nonbonding valence electrons.



Free Response 200

The following chemical equation represents the reaction that occurs when methylamine dissolves in water to form a basic solution.

$CH_3NH_{2(aq)} + H_2O_{(l)} \rightarrow CH_3NH_3^+{}_{(aq)} + OH^-{}_{(aq)}$

The pH of 2.65 M $CH_3NH_{2(aq)}$ is 12.54. Determine the value of K_b for methylamine.

4.54×10^{-4}

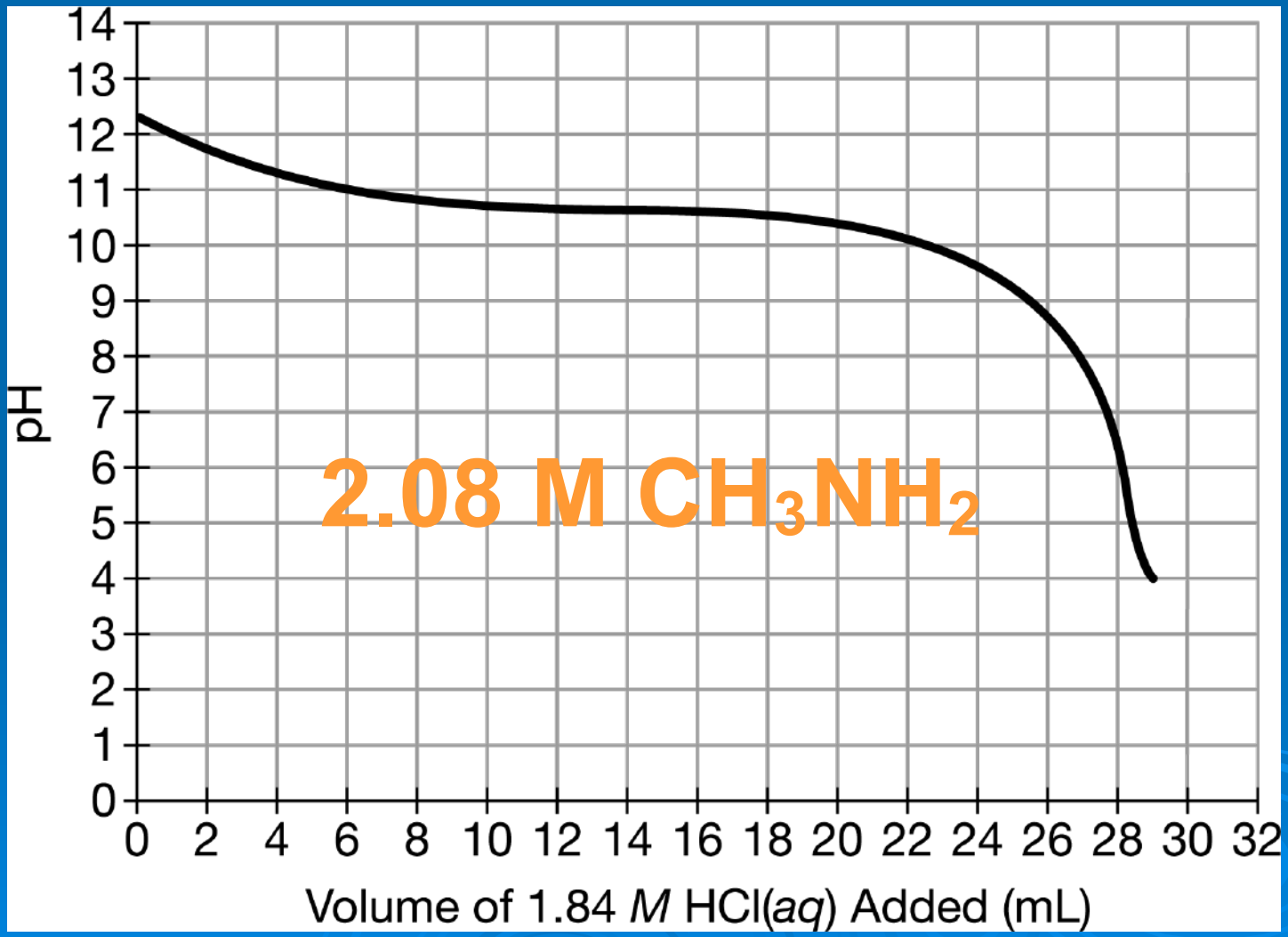
Free Response 300

A 25.00 mL sample of a $CH_3NH_{2(aq)}$ solution of unknown concentration is titrated with 1.84 M $HCl_{(aq)}$. Following is a graph that shows pH versus the volume of 1.84 M $HCl_{(aq)}$ added during the titration.

If 28.25 mL of 1.84 M $HCl_{(aq)}$ was required to reach the equivalence point, calculate the concentration of the $CH_3NH_{2(aq)}$ solution of unknown concentration.

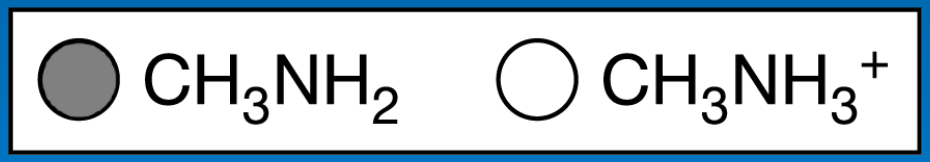
GRAPH ON NEXT SLIDE →

Free Response 300 (con't)

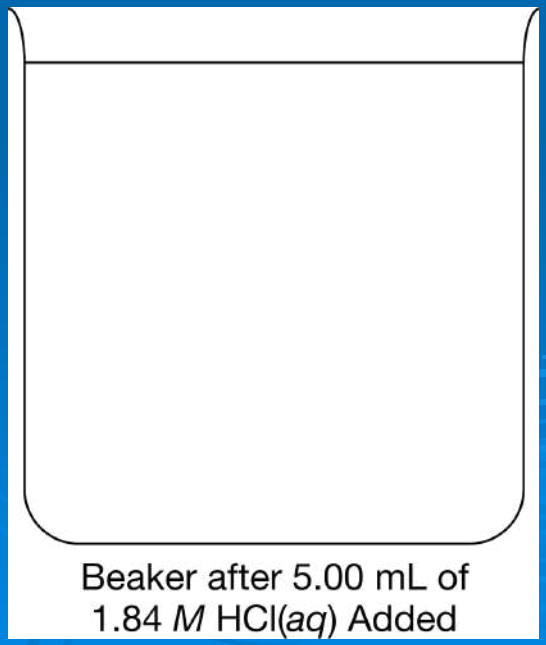


Free Response 400

Using the symbols in the legend below, draw particles in the beaker to represent the relative amounts of the two species, CH_3NH_2 and $CH_3NH_3^+$, in the solution after the first 5.00 mL of titrant had been added to the $CH_3NH_{2(aq)}$ solution.

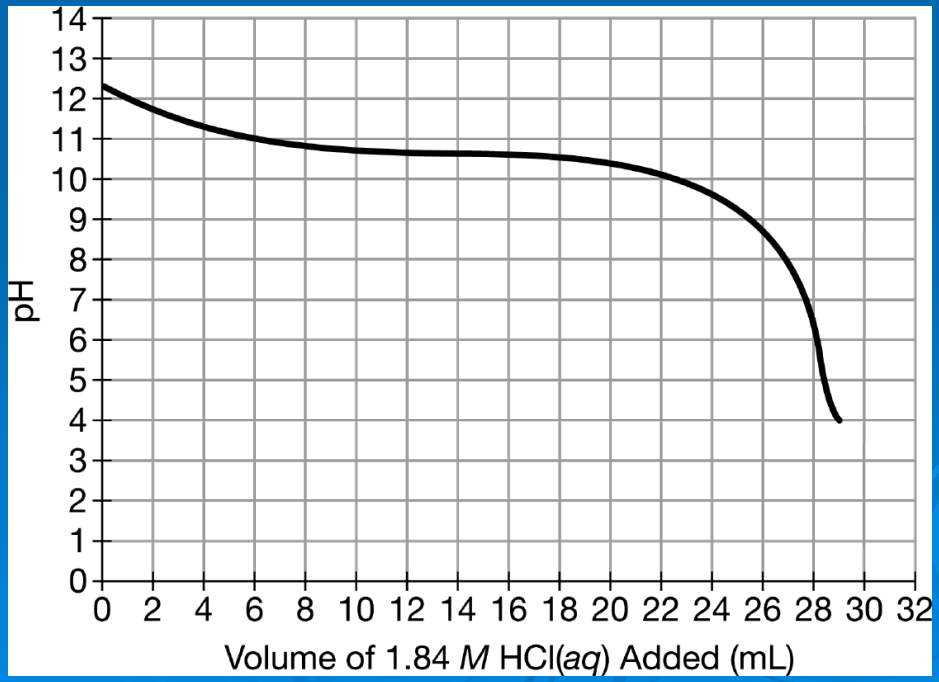


Must have more CH_3NH_2 particles than $CH_3NH_3^+$ particles.



Free Response 500

Explain why the titration curve shows only a small change in pH per volume of acid added when the total amount of acid added is about 14.0 mL. Include a balanced chemical equation as part of your answer.



Free Response 500 (con't)

14.0 mL is half the equivalence point, so the concentrations of the base and the conjugate acid are equal making a buffer, so added acid or base does not affect the pH as much.

$H_3O^+ + CH_3NH_2 \rightarrow H_2O + CH_3NH_3^+$