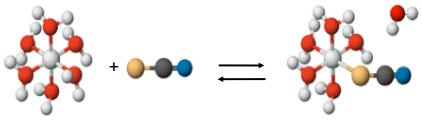
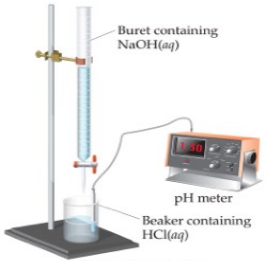
Chemistry 223 Exam I Review
Chapters 13 and 14 ("Part I & II")





Chemistry 223
Professor Michael Russell

Last update: 6/14/23

MAR

We place 0.010 mol of $N_2O_4(g)$ in a 2.0 L flask at 200 °C. After reaching equilibrium, $[N_2O_4]$ = 0.0038 M. Calculate K_c for the following reaction:

$N_2O_4\ (g) \rightleftharpoons 2\ NO_2(g)$

A. 1600
B. 1.5×10^{-3}
C. 6.1×10^{-4}
D. 8.8×10^{-6}
E. -3.1×10^{-3}

MAR

Given the following two equilibria:

$NiCO_3(s) \rightleftharpoons Ni^{2+}(aq) + CO_3^{2-}(aq)$ $K_1 = 6.6 \times 10^{-9}$

$HCO_3^-(aq) + H_2O(l) \rightleftharpoons CO_3^{2-}(aq) + H_3O^+(aq)$ $K_2 = 4.8 \times 10^{-11}$

calculate the equilibrium constant for the following reaction:

$NiCO_3(s) + H_3O^+(aq) \rightleftharpoons Ni^{2+}(aq) + HCO_3^-(aq) + H_2O(l)$

A. 7.3×10^{-3}
B. 3.2×10^{-19}
C. 140
D. 1.8×10^{-9}
E. 1100

MAR

$H_2(g) + I_2(g) \rightleftharpoons 2\ HI(g)$, $K_c = 54.3$

Initially, $[H_2]$ = 0.00623 M, $[I_2]$ = 0.00414 M, and [HI] = 0.0424 M. Find the equilibrium concentrations.

A. $[H_2]$ = 0.00201 M, $[I_2]$ = 0.00112 M, [HI] = 0.0643 M
B. $[H_2]$ = 0.00222 M, $[I_2]$ = 0.00168 M, [HI] = 0.0112 M
C. $[H_2]$ = 0.00917 M, $[I_2]$ = 0.00667 M, [HI] = 0.0212 M
D. $[H_2]$ = 0.00676 M, $[I_2]$ = 0.00467 M, [HI] = 0.0414 M
E. $[H_2]$ = 0.00623 M, $[I_2]$ = 0.00414 M, [HI] = 0.0424 M

MAR

ΔH^o = –18.8 kJ, K_c = 10.5, for:

$2\ CH_2Cl_2(g) \rightleftharpoons CH_4(g) + CCl_4(g)$

If the temperature on the equilibrium system is suddenly decreased, the value of K_c:

A. increases
B. decreases
C. remains the same

MAR

You add 0.535 g of NaOH (MM = 40.0 g mol^{-1}) to 100.0 mL of water at 25 °C. What is $[H_3O^+]$ in this solution?

A. 0.134 M
B. 7.48×10^{-14} M
C. 1.34×10^{13} M
D. 6.87×10^{-12} M

MAR

Considering only H_2S ($K_a = 1 \times 10^{-7}$) and HCN ($K_a = 4 \times 10^{-10}$), predict in which direction the following equilibrium lies:

$$HCN(aq) + HS^-(aq) \rightleftharpoons CN^-(aq) + H_2S(aq)$$

A. equilibrium lies to the left
B. equilibrium lies to the right
C. equilibrium is perfectly balanced left and right
D. cannot be determined

MAR

What is $[H_3O^+]$ in a 0.10 M solution of HCN at 25 °C? (K_a for HCN = 4.0×10^{-10})

A. 1.6×10^{-9} M
B. 6.3×10^{-6} M
C. 2.0×10^{-5} M
D. 4.0×10^{-11} M
E. 0.10 M

MAR

In a 0.15 M solution of Na_2CO_3, what are $[H_3O^+]$, $[OH^-]$ and the pH? K_b for CO_3^{2-} is 2.1×10^{-4}.

	$[H_3O^+]$	$[OH^-]$	pH
A.	5.6×10^{-3}	1.8×10^{-12}	5.61
B.	1.8×10^{-12}	5.6×10^{-3}	11.75
C.	5.6×10^{-3}	1.8×10^{-12}	11.75
D.	1.8×10^{-12}	5.6×10^{-3}	5.61

MAR

Place the following acids in order of increasing acid strength.

(a) Anilinium ion, $pK_a = 4.60$
(b) Benzilic acid, $pK_a = 3.09$
(c) Chloroacetic acid, $pK_a = 2.98$
(d) Dibromophenol, $pK_a = 8.06$

A. a, b, c, d
B. d, c, b, a
C. c, b, a, d
D. d, a, b, c
E. a, c, d, c

MAR

Classify the following as ***Lewis*** acids or bases.

BH_3, NH_3, Cl^{-1}, Al^{3+}, Cr^{3+}

A. acid, base, base, acid, acid
B. base, base, base, acid, acid
C. base, acid, acid, base, base
D. acid, base, acid, base, base
E. Public Enemy is #1!

MAR

You have a solution of NH_4Cl. What effect will addition of NH_3 have on the pH of the solution?

A. increase pH
B. no effect
C. decrease pH
D. cannot tell from information given

MAR

You have a solution of NH_4Cl. What effect will addition of NaCl have on the pH of the solution?

A. increase pH
B. no effect
C. decrease pH
D. cannot tell from information given

MAR

Which choice would be an ideal buffer solution?

A. 0.20 M HCN and 0.10 M KCN
B. 0.20 M HCl and 0.10 M KOH
C. 0.20 M CH_3CO_2H and 0.10 M HCO_2H
D. 0.10 HCl and 0.010 M KCl
E. 0.10 M CH_3OH and 0.10 M NaOH

MAR

What is the pH of a buffer that is composed of 0.20 M NH_4Cl and 0.20 M NH_3? (K_a for NH_4^+ = 5.6×10^{-10})

A. 4.85
B. 5.65
C. 7.00
D. 9.25
E. 10.05

MAR

What is the pH of a buffer that is composed of 0.20 M NH_4Cl and 0.50 M NH_3? (K_a for NH_4^+ = 5.6×10^{-10})

A. 4.75
B. 5.65
C. 7.00
D. 9.25
E. 9.65

MAR

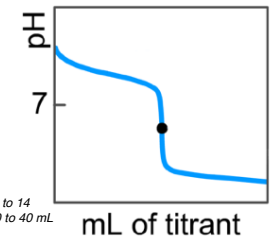
What volume of 0.10 M sodium acetate must be added to 100. mL of 0.10 M acetic acid (K_a = 1.8×10^{-5}) to have a pH of 4.00?

A. 100. mL
B. 50. mL
C. 36 mL
D. 18 mL
E. 9.0 mL

MAR

What type of titration does the graph below represent?

A. strong acid + strong base
B. strong base + strong acid
C. weak acid + strong base
D. weak base + strong acid
E. weak base + weak acid



pH scale: from 0 to 14
Volume scale: from 0 to 40 mL

MAR

You mix 15.0 mL of 0.400 M HCl with 15.0 mL of 0.400 M NH_3. What is the pH of the resulting solution? (K_b = 1.8 x 10^{-5})

A. 11.43
B. 9.26
C. 7.00
D. 5.54
E. 4.98

MAR

0.40 g of NaOH (MM = 40. g/mol) are mixed with 100 mL of 0.10 M acetic acid. What is the pH of the resulting solution? (K_a = 1.8 x 10^{-5})

A. 1.00
B. 2.87
C. 7.00
D. 8.87
E. 13.00

MAR

What is the pH of the solution when 50. mL of 0.10 M HCl and 100. mL of 0.10 M NaCN are mixed? K_a(HCN) = 4.0 x 10^{-10}

A. 8.65
B. 8.80
C. 5.20
D. 5.35
E. 9.40

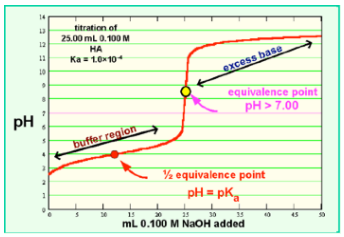
MAR

Add 40. mL of 0.50 M NaOH to 50.0 mL of 1.00 M NH_4Cl. What is the pH of the resulting solution? $K_b(NH_3)$ = 1.8 x 10^{-5}

A. 4.56
B. 4.74
C. 7.00
D. 9.08
E. 10.70

MAR

End of Review - *good luck with your studying!*



Need more practice?

- *Practice Problem Sets (online)*
- *Concept Guides (Companion and online)*
- *Chapter Guides (online)*
- *End of Chapter Problems in Textbook (every other question has answer at end)*

Good luck with your studying!

MAR