General Chemistry II Lecture Spring 2020 Quiz 8 4/8/20 W Sect A Dr. Hahn due 24 hours from start of quiz
(I could not come up with enough material for a quiz without including material that I will cover in class today so I am giving everyone extra time to complete the quiz. I however think you will probably be able to complete the quiz open book, open notebook in the 1 hour that you normally have to complete the quiz)

Name Key (print) Kw=[H+][OH-] = 1.0×10^{-14} pKw = pH+pOH = 14

show work for partial credit &full credit on the Short Answer Questions. p(anything) = - log (anything){pH = pKa + log [base]/[acid]}

MULTIPLE CHOICE. Choose the one best alternative. (1 pt per MC question, 5 pts total)

1) Which statement about buffers is true? 1) D

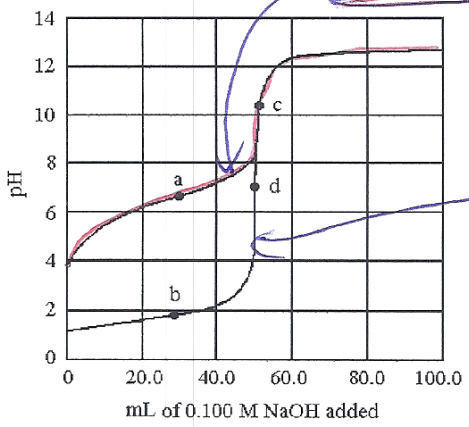
A) Buffers have a pH = 7.

B) A buffer does not change pH on addition of a strong acid or strong base.

C) Buffers consist of a strong acid and its conjugate base.

D) Buffers resist change in pH upon addition of small amounts of strong acid or strong base.

The following plot shows two titration curves, each representing the titration of 50.00 mL of 0.100 M acid with 0.100 M NaOH.



2) Which point a–d represents a buffer region? 2) A

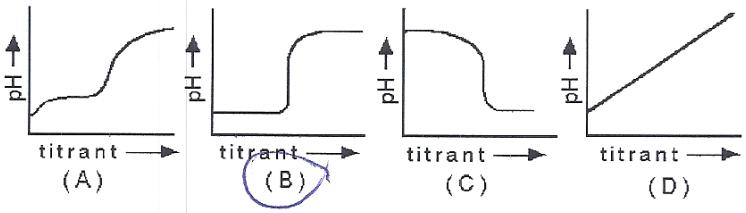
A) point a B) point b C) point c D) point d

3) Which is a net ionic equation for the neutralization of a strong acid with a strong base? 3) C

A) $HI(aq) + NaOH(aq) = H_2O(l) + NaI(aq)$ B) $HF(aq) + NaOH(aq) = H_2O(l) + NaF(aq)$

C) $H_3O^+(aq) + OH^-(aq) = 2\ H_2O(l)$ D) $HCl(aq) + OH^-(aq) = H_2O(l) + Cl^-(aq)$

Use the graphs below to answer the following questions.



4) What is the characteristic pH–titrant curve for the titration of a strong acid by a strong base? 4) B

A) A B) B C) C D) D

5) What is the common ion in a solution prepared by mixing 0.55 M $LiCH_3CO_2$ with 0.10 M CH_3CO_2H? 5) B

A) H_3O^+ B) $CH_3CO_2^-$ C) OH^- D) Li^+

6) What is the pH at the equivalence point of a weak acid–strong base titration? 6) A

A) pH > 7 B) pH = 14.00 C) pH = 7 D) pH < 7

conjugate base = basic pH > 7

Short Answer. Show work. p(Anything)= - log (Anything), [H+] = antilog (- pH) M = moles / liter, 1000 mL = 1 Liter

7) What is the pH of a buffer system made by dissolving 5.23 grams of NH_4Cl (FW = 53.50 g/mol) and 10.00 mL of 6.00 M NH_3 in enough water to make 1.000 L of the solution ? $K_b = 1.8 \times 10^{-5}$ for NH_3 (8 pts) (use the chart) (show work)

$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

NH_3	NH_4^+	OH^-
0.06 M	0.0978 M	0
−x	+x	+x
0.06−x	0.0978+x	+x

½ pt each — 4½ pt.

5.23 g NH_4Cl × 1 mol / 53.50 g = 0.0978 mol/L = 0.0978 M (1 pt)

10.00 mL NH_3 × 6.00 mol NH_3 / L NH_3 × 1000 mL / L = 0.06 mol/L (1 pt)

(2) $1.8 \times 10^{-5} = \frac{(0.0978+x)(x)}{(0.06-x)}$ x small

$1.8 \times 10^{-5} = \frac{(0.0978)(x)}{(0.06)} \rightarrow$

$\frac{(1.8 \times 10^{-5})(0.06)}{(0.0978)} = x$

(3) $[OH^-] = x = 1.10 \times 10^{-5}$ 0.06 M

$[H^+] = \frac{1.0 \times 10^{-14}}{1.10 \times 10^{-5}} = 9.09 \times 10^{-10}$

$pH = -\log(9.09 \times 10^{-10}) = 9.04$ 2 pt.

8) A buffer solution is prepared by dissolving 0.100 mol of NaH_2PO_4 and 0.100 mol of NaOH in enough water to make 1.00 L of solution. What is the pH of the $H_2PO_4^-/HPO_4^{2-}$ buffer if the $K_{a2} = 6.2 \times 10^{-8}$?

{pH = pKa + log [base]/[acid]} (8 pts)

$pH = pKa + \log \frac{[Na_2HPO_4]}{[NaH_2PO_4]}$ (2 pt)

$pH = -\log(6.2 \times 10^{-8}) - \log\left(\frac{0.100}{0.100}\right)$ (4 pt)

$pH = 7.21 - 0 = 7.21$ (2 pt)

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Name Key (print) $K_w = [H^+][OH^-] = 1.0 \times 10^{-14}$ $pK_w = pH + pOH = 14$

show work for partial credit & full credit on the Short Answer Questions. p(anything) = - log (anything) {pH = pKa + log [base]/[acid]}

MULTIPLE CHOICE. Choose the one best alternative. (1 pt per MC question, 5 pts total)

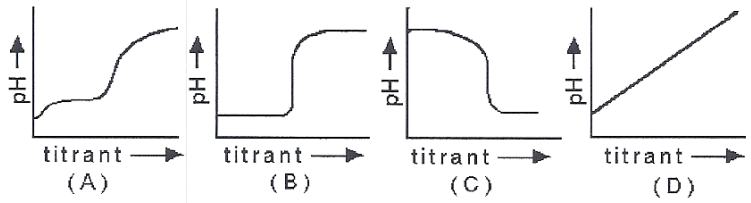
1) Which statement about buffers is true? 1) B

A) Buffers have a pH = 7.
B) Buffers resist change in pH upon addition of small amounts of strong acid or strong base.
C) Buffers consist of a strong acid and its conjugate base.
D) A buffer does not change pH on addition of a strong acid or strong base.

2) What is the Henderson-Hasselbalch equation for the acidic buffer HA/A⁻? 2) C

A) $pH = -\log[H_3O^+]$
B) $pH = pK_a - \log\{[A^-]/[HA]\}$
C) $pH = pK_a + \log\{[A^-]/[HA]\}$
D) pH = 14 - pOH

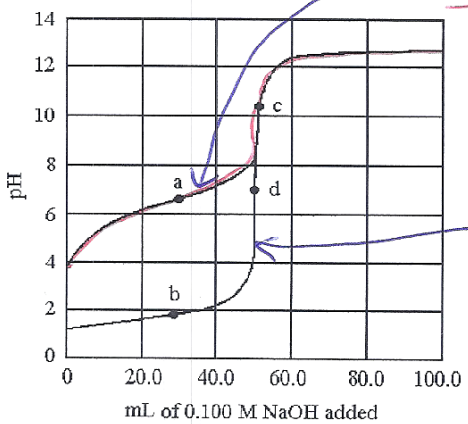
Use the graphs below to answer the following questions.



3) What is the characteristic pH-titration curve for the titration of a weak acid by a strong base? 3) A

A) A B) B C) C D) D

The following plot shows two titration curves, each representing the titration of 50.00 mL of 0.100 M acid with 0.100 M NaOH.



weak acid - strong base

strong acid - strong base

4) Which point a-d represents the equivalence point for the titration of a strong acid? 4) D

A) point a B) point b C) point c D) point d

no buffer w strong acid

5) Which point a–d represents a buffer region? 5) A

A) point a B) point b C) point c D) point d

6) When equal molar amounts of the following sets of compounds are mixed in water, which will **not** form a buffer solution? 6) _____

A) HNO_3 with $LiNO_3$ (strong acid + salt) B) KH_2PO_4 with K_2HPO_4 (weak acid/base)

C) NH_3 with NH_4I (weak base/acid) D) CH_3CO_2H with $LiCH_3CO_2$ (weak acid / base)

Short Answer. Show work. p(Anything)= - log (Anything), [H+] = antilog (- pH) M = moles / liter, 1000 mL = 1 Liter

7) What is the pH of a buffer system made by dissolving 10.70 grams of NH_4Cl (FW = 53.50 g/mol) and 20.00 mL of 12.0 M NH_3 in enough water to make 1.000 L of the solution ? $K_b = 1.8 \times 10^{-5}$ for NH_3 (8 pts)

(use the chart) (show work) (4 pts) (½ pt each)

$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$

	NH_3	NH_4^+	OH^-
I	0.24 M	0.2 M	0
C	−X	+X	+X
E	0.24−X	0.2+X	X

base acid

10.70 / 53.50 = 0.2 mol (in 1 L) → 0.2 M

20.00 ml / 1000 ml/l * 12.0 mol/l = 0.24 mol (in 1 L) → 0.24 M (1 pt)

$1.8 \times 10^{-5} = \frac{(0.2+X)(X)}{(0.24-X)}$

$1.8 \times 10^{-5} = \frac{(0.2)(X)}{0.24}$

$[OH] = X = 2.16 \times 10^{-5}$

$pOH = -\log(2.16 \times 10^{-5}) = 4.67$

X ≪ small

8) A buffer solution is prepared by dissolving 0.200 mol of NaH_2PO_4 and 0.100 mol of ~~NaOH~~ $Na_2HPO_4^{2-}$ in enough water to make 1.00 L of solution. What is the pH of the $H_2PO_4^-/HPO_4^{2-}$ buffer if the $K_{a2} = 6.2 \times 10^{-8}$? (8 pts) (2 pts)

{pH = pKa + log [base]/[acid]}

$pH = 14 - 4.67$

$pH = 9.33$

$pH = pK_a + \log\frac{(base)}{(acid)}$ (2 pts)

$pH = -\log(6.2 \times 10^{-8}) + \log\left(\frac{0.100\ M}{0.200\ M}\right)$ (4 pts)

$pH = 5.91$ (2 pts)

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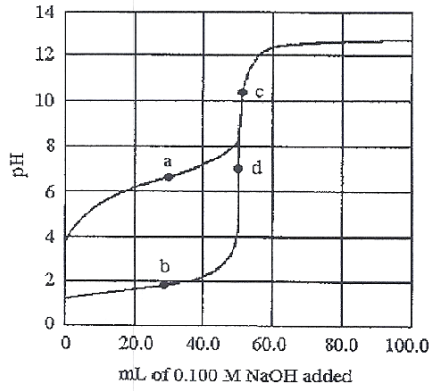

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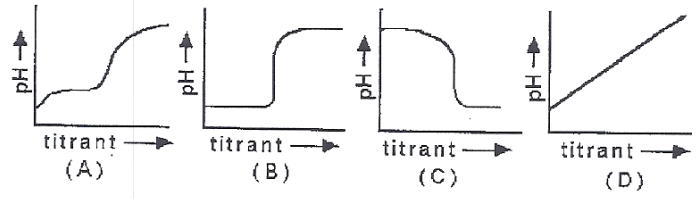

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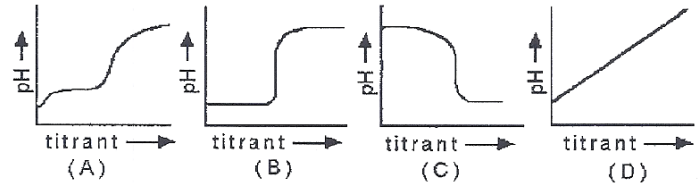

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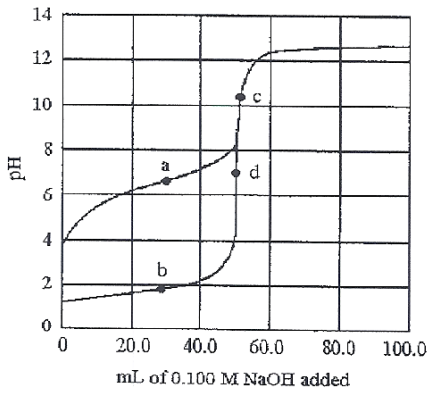

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Na_2HPO_4

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