HW05 - Buffers, Titrations, and Polyprotics

Question 1 — 1 pts

When an acid and base neutralize each other, the products are generally water and...

- a colloid.
- a salt.
- a gel.
- an ion.

Question 2 — 1 pts

How many moles of $Ca(OH)_2$ are needed to neutralize three moles of HCl?

- 2
- 1
- 1.5
- 3

Question 3 — 1 pts

An aqueous solution is prepared with 2 moles of HCl and 1 mole of $Ca(OH)_2$. The resulting solution contains mainly...

- water, Cl^- ions, and Ca^{2+} ions.
- water, Cl^- ions, H^+ ions, and Ca^{2+} ions.
- water, Cl^- ions, H^+ ions, OH^- ions, and Ca^{2+} ions.
- water, Cl^- ions, OH^- ions, and Ca^{2+} ions.

Question 4 — 1 pts

Identify the products of the following chemical reaction:

$3LiOH + H_3PO_4 \longrightarrow$

- $3H^+ + 3O_2 + H_3Li_3$
- $Li_3PO_4 + 3H_2O$
- $Li_3P + 2H_2O + H_3O_5$
- $3LiH + (OH)_3PO_4$

Question 5 — 1 pts

Identify the products of the following chemical reaction:

$Sr(OH)_2 + 2HNO_3 \longrightarrow$

- $Sr(NO_3)_2 + 2H_2O$
- $SrNO_3 + H_2O$
- $Sr(NO_2)_2 + 2H_2O_2$
- $SrH_2 + HNO_5$

Question 6 — 1 pts

Aqueous ammonia can be used to neutralize sulfuric acid and nitric acid to produce two salts extensively used as fertilizers. They are...

- NH_4SO_4 and NH_4NO_3, respectively
- cyanamide and cellulose nitrate, respectively
- $(NH_4)_2SO_4$ and NH_4NO_3, respectively
- NH_4SO_3 and NH_4OH, respetively

Question 7 — 1 pts

Identify the salt that is produced from the acid-base neutralization reaction between potassium hydroxide and acetic acid.

- potassium amide
- potassium formate
- potassium acetate
- potassium cyanide

Question 8 — 1 pts

What is the pH of an aqueous solution that is 0.018 M $C_6H_5NH_2$ ($K_b = 4.3x10^{-10}$) and 0.12 M $C_6H_5NH_3Cl$?

- 4.63
- 3.81
- 4.02
- 2.87

Question 9 — 1 pts

A buffer solution is made by dissolving 0.45 moles of a weak acid (HA) and 0.33 moles of KOH into 710 mL of solution. What is the pH of this buffer? $K_a = 6x10^{-6}$ for HA.

- 13.23
- 5.22
- 5.66
- 8.34

Question 10 — 1 pts

Which one of the following combinations is NOT a buffer solution?

- CH_3COOH and $NaCH_3COO$
- HBr and KBr
- NH_3 and $(NH_4)_2SO_4$
- HCN and NaCN

Question 11 — 1 pts

Which of the following mixtures will be a buffer when dissolved in a liter of water?

- 0.1 mol $Ca(OH)_2$ and 0.3 mol HI
- 0.2 mol HF and 0.1 mol NaOH
- 0.2 mol HBr and 0.1 mol NaOH
- 0.3 mol NaCl and 0.3 mol HCl

Question 12 — 1 pts

What is the pH of a solution which is 0.600 M in dimethylamine ($(CH_3)_2NH$) and 0.400 M in dimethylamine hydrochloride ($(CH_3)_2NH_2Cl$)? K_b for dimethylamine = $7.4x10^{-4}$.

- 10.87
- 11.05
- 10.78
- 11.21

Question 13 — 1 pts

What would be the final pH if 0.0100 moles of solid NaOH were added to 100mL of a buffer solution containing 0.600 molar formic acid (ionization constant = $1.8x10^{-4}$) and 0.300 M sodium formate?

- 3.44
- 3.65
- 3.84
- 4.05

Question 14 — 1 pts

A buffer was prepared by mixing 0.200 moles of ammonia ($K_b = 1.8x10^{-5}$) and 0.200 moles of ammonium chloride to form an aqueous solution with a total volume of 500 mL. 250 mL of the buffer was added to 50.0 mL of 1.00 M HCl. What is the pH of this second solution?

- 8.78
- 8.18
- 8.38
- 8.53

Question 15 — 1 pts

A solution is 0.30 M in NH_3. What concentration of NH_4Cl would be required to achieve a buffer solution with a final pH of 9.0? $K_b = 1.8x10^{-5}$ for NH_3.

- 0.10 M
- 0.45 M
- 0.54 M
- 0.32 M

Question 16 — 1 pts

What is the pH at the half-stoichiometric point for the titration of 0.22 M HNO_2(aq) with 0.1 M KOH(aq)? For HNO_2, $K_a = 4.3x10^{-4}$.

- 3.37
- 2.31
- 2.01
- 7.00

Question 17 — 1 pts

For the titration of 50.0 mL of 0.020 M aqueous salicylic acid with 0.020 M KOH (aq), calculate the pH after the addition of 55.0 mL of the base. For salicylic acid, $pK_a = 2.97$.

- 7.00
- 11.26
- 10.98
- 11.02

Question 18 — 1 pts

Consider the titration of 50.0 mL of 0.0200 M HClO(aq) with 0.100 M NaOH(aq). What is the formula of the main species in the solution after the addition of 10.0 mL of base?

- ClO^-
- ClO_2
- HClO
- NaOH

Question 19 — 1 pts

50.0 mL of 0.0018 M aniline (a weak base) is titrated with 0.0048 M HNO_3. How many mL of the acid are required to reach the equivalence point?

- 18.8 mL
- 133 mL
- This is a bad titration as HNO_3 is not a strong acid.
- 4.21 mL

Question 20 — 1 pts

When we titrate a weak base with a strong acid, the pH at the equivalence point will be...

- It is impossible to know unless we are given the K_b of the weak base.
- pH < 7
- pH > 7
- pH = 0

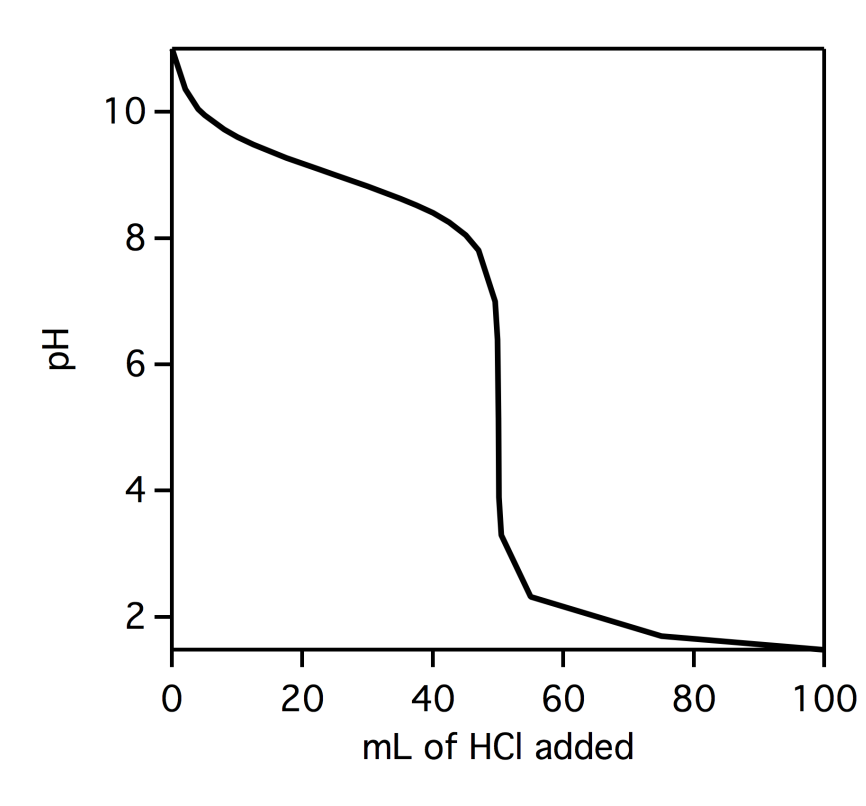
Question 21 — 1 pts

What is the pH at the equivalence point in the titration of 10.0 mL of 0.35 M unknown acid HZ with 0.200 M NaOH? $K_a = 2.4x10^{-7}$ for the unknown acid HZ

- 7.00
- 4.14
- 10.1
- 9.86

Question 22 — 1 pts

What is the pH at the equivalence point of the titration pictures below?



- 8
- 5
- 9
- 2

Question 23 — 1 pts

Look at the titration diagram in the question above. What type of titration is occurring?

- a weak base titrated with a weak acid
- a weak base titrated with a strong acid
- a strong base titrated with a weak acid
- a strong base titrated with a strong acid

Question 24 — 1 pts

The acid form of an indicator is yellow and its anion is blue. The K_a of this indicator is 10^{-5}. What will be the approximate pH range over which this indicator changes color?

- 6 < pH < 8
- 3 < pH < 5
- 4 < pH < 6
- 5 < pH < 7

Question 25 — 1 pts

The unionized form of an acid indicator is yellow and its anion is blue. The K_a of this indicator is 10^{-5}. What will be the color of the indicator in a solution of pH 3?

- yellow
- orange
- blue
- green

Question 26 — 2 pts

Aspartic acid is a polypeptide side chain found in proteins. The pK_a of aspartic acid is 3.86. If this polypeptide were in an aqueous solution with a pH of 7, the side chain would have what charge?

- neutral
- positive
- negative
- there is no way to know

Question 27 — 1 pts

Blood contains a buffer of carbonic acid (H_2CO_3) and hydrogen carbonate ion (HCO_3^-) that keeps the pH at a relatively stable 7.40. What is the ratio of $[HCO_3^-] / [H_2CO_3]$ in blood? $K_{a1} = 4.30x10^{-7}$ for H_2CO_3. (Hint: Assume $[CO_3^{2-}] = 0$)

- 3.98×10^{-8}
- 10.8
- 1.71×10^{-14}
- 0.0926

Question 28 — 2 pts

H_2SO_4 is a strong acid because the first proton ionizes 100%. The K_a of the second proton is $1.1x10^{-2}$. What would be the pH of a solution that is 0.100 M H_2SO_4? Account for the ionization of both protons.

- 0.963
- 1.00
- 0.955
- 2.05