HW05 - Buffers, Titrations, and Polyprotics

⚠ This is a preview of the published version of the quiz

Started: Feb 23 at 12:43pm

Quiz Instructions

<div align="center">

Homework 05

Buffers, Titrations, and Polyprotics

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Question 1	**1 pts**

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

○ an ion.

○ a colloid.

○ a gel.

○ a salt.

Question 2	**1 pts**

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

○ 2

○ 1.5

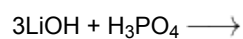○ 1

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

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

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Question 4

1 pts

Identify the products of the following chemical reaction:

$3LiOH + H_3PO_4 \longrightarrow$

○ $3LiH + (OH)_3PO_4$

○ $Li_3P + 2H_2O + H_3O_5$

○ $3H^+ + 3O_2 + H_3Li_3$

○ $Li_3PO_4 + 3H_2O$

Question 5

1 pts

Identify the products of the following chemical reaction:

$Sr(OH)_2 + 2HNO_3 \longrightarrow$
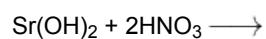
○ $Sr(NO_3)_2 + 2H_2O$

○ $SrNO_3 + H_2O$

○ $SrH_2 + HNO_5$

○ $Sr(NO_2)_2 + 2H_2O_2$
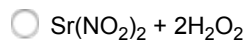
Question 6   **1 pts**

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

○ $(NH_4)_2SO_4$ and NH_4NO_3, respectively

○ cyanamide and cellulose nitrate, respectively

○ NH_4SO_3 and NH_4OH, respetively

○ NH_4SO_4 and NH_4NO_3, respectively

Question 7   **1 pts**

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

○ potassium cyanide

○ potassium acetate

○ potassium formate

○ potassium amide

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 $C_6H_5NH_3Cl$?

○ 2.87

○ 4.63

○ 3.81

○ 4.02

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.

○ 5.22

○ 5.66

○ 8.34

○ 13.23

Question 10   1 pts

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

○ HBr and KBr

○ NH_3 and $(NH_4)_2SO_4$

○ HCN and NaCN

○ CH_3COOH and $NaCH_3COO$

Question 11   1 pts

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

○ 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

○ 0.1 mol $Ca(OH)_2$ and 0.3 mol HI

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 = 7.4×10^{-4}.

○ 10.87

○ 11.21

○ 11.05

○ 10.78

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 = 1.8×10^{-4}) and 0.300 M sodium formate?

○ 3.65

○ 4.05

○ 3.84

○ 3.44

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

○ 8.38

○ 8.53

○ 8.18

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.

○ 0.54 M

○ 0.10 M

○ 0.32 M

○ 0.45 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

○ 7.00

○ 2.01

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 salycylic acid, pK_a = 2.97.

○ 10.98

○ 11.02

○ 11.26

○ 7.00

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^-

○ HClO

○ NaOH

○ ClO_2

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?

○ 4.21 mL

○ This is a bad titration as HNO_3 is not a strong acid.

○ 133 mL

○ 18.8 mL

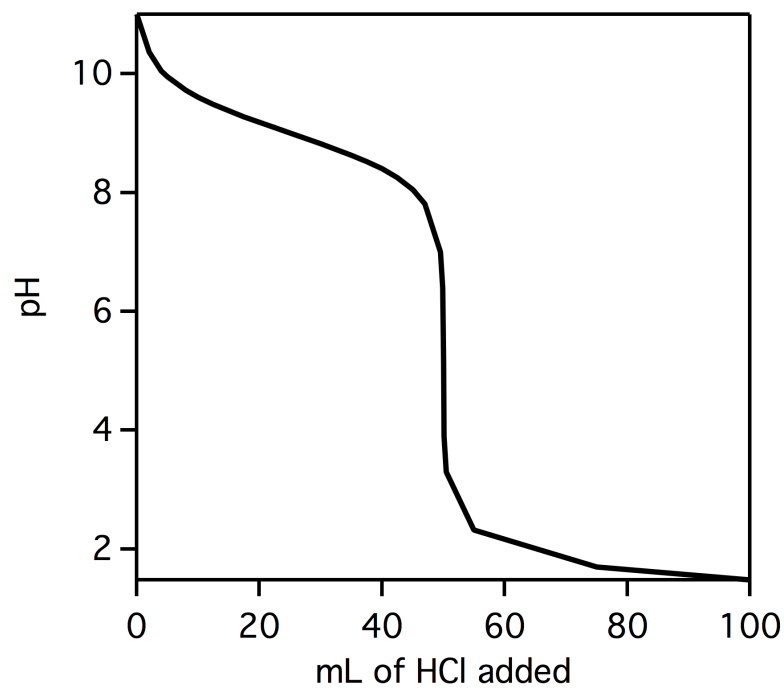### Question 20   1 pts

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

○ pH < 7

○ It is impossible to know unless we are given the K_b of the weak base.

○ 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 = 2.4×10^{-7} for the unknown acid HZ

○ 10.1

○ 4.14

○ 7.00

○ 9.86

Question 22   1 pts

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

- ○ 8
- ○ 2
- ○ 5
- ○ 9

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

○ 4 < pH < 6

○ 3 < pH < 5

○ 6 < pH < 8

○ 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?

○ green

○ yellow

○ blue

○ orange

Question 26   **1 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

○ there is no way to know

○ negative

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? $K_{a1} = 4.30 \times 10^{-7}$ for H_2CO_3. (Hint: Assume $[CO_3^{2-}] = 0$)

○ 0.0926

○ 10.8

○ 3.98×10^{-8}

○ 1.71×10^{-14}

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 1.1×10^{-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

○ 0.955

○ 1.00

○ 2.05

Question 29   1 pts

What is the pH of a 3.4×10^{-8} M $HClO_4$ solution at room temperature?

○ 7.0

○ 5.3

○ 7.1

○ 6.9

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