HW06 - Buffers, Titrations, and Polyprotics

Question 1
1.0 pts

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

a. a gel.
b. a colloid.
c. an ion.
d. a salt.

Question 2
1.0 pts

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

a. 1.5
b. 3
c. 2
d. 1

Question 3
1.0 pts

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

a. water, Cl^- ions, and Ca^{2+} ions.
b. water, Cl^- ions, H^+ ions, OH^- ions, and Ca^{2+} ions.
c. water, Cl^- ions, OH^- ions, and Ca^{2+} ions.
d. water, Cl^- ions, H^+ ions, and Ca^{2+} ions.

Question 4
1.0 pts

Identify the products of the following chemical reaction:

$3LiOH + H_3PO_4 \longrightarrow$

a. $3H^+ + 3O_2 + H_3Li_3$
b. $Li_3P + 2H_2O + H_3O_5$
c. $3LiH + (OH)_3PO_4$
d. $Li_3PO_4 + 3H_2O$

Question 5
1.0 pts

Identify the products of the following chemical reaction:

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

a. $SrH_2 + HNO_5$
b. $SrNO_3 + H_2O$
c. $Sr(NO_2)_2 + 2H_2O_2$
d. $Sr(NO_3)_2 + 2H_2O$

Question 6
1.0 pts

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

a. cyanamide and cellulose nitrate, respectively
b. NH_4SO_4 and NH_4NO_3, respectively
c. NH_4SO_3 and NH_4OH, respetively
d. $(NH_4)_2SO_4$ and NH_4NO_3, respectively

Question 7
1.0 pts

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

a. potassium cyanide
b. potassium amide
c. potassium formate
d. potassium acetate

Question 8
1.0 pts

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

a. 3.81
b. 4.02
c. 4.63
d. 2.87

Question 9
1.0 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? $K_a = 6 \times 10^{-6}$ for HA.

a. 5.22
b. 8.34
c. 13.23
d. 5.66

Question 10
1.0 pts

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

a. HBr and KBr
b. HCN and NaCN
c. CH_3COOH and $NaCH_3COO$
d. NH_3 and $(NH_4)_2SO_4$

Question 11
1.0 pts

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

a. 0.2 mol HBr and 0.1 mol NaOH
b. 0.3 mol NaCl and 0.3 mol HCl
c. 0.2 mol HF and 0.1 mol NaOH
d. 0.1 mol $Ca(OH)_2$ and 0.3 mol HI

Question 12
1.0 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}.

a. 11.21
b. 10.78
c. 11.05
d. 10.87

Question 13
1.0 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?

a. 3.65
b. 3.44
c. 4.05
d. 3.84

Question 14
1.0 pts

A buffer was prepared by mixing 0.200 moles of ammonia ($K_b = 1.8 \times 10^{-5}$) 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?

a. 8.38
b. 8.53
c. 8.18
d. 8.78

Question 15
1.0 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? $K_b = 1.8 \times 10^{-5}$ for NH_3.

a. 0.32 M
b. 0.54 M
c. 0.10 M
d. 0.45 M

Question 16
1.0 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, $K_a = 4.3 \times 10^{-4}$.

a. 2.31
b. 7.00
c. 2.01
d. 3.37

Question 17
1.0 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, $pK_a = 2.97$.

a. 10.98
b. 11.26
c. 7.00
d. 11.02

Question 18
1.0 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?

a. HClO
b. ClO^-
c. ClO_2
d. NaOH

Question 19
1.0 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?

a. 133 mL
b. This is a bad titration as HNO_3 is not a strong acid.
c. 18.8 mL
d. 4.21 mL

Question 20
1.0 pts

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

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

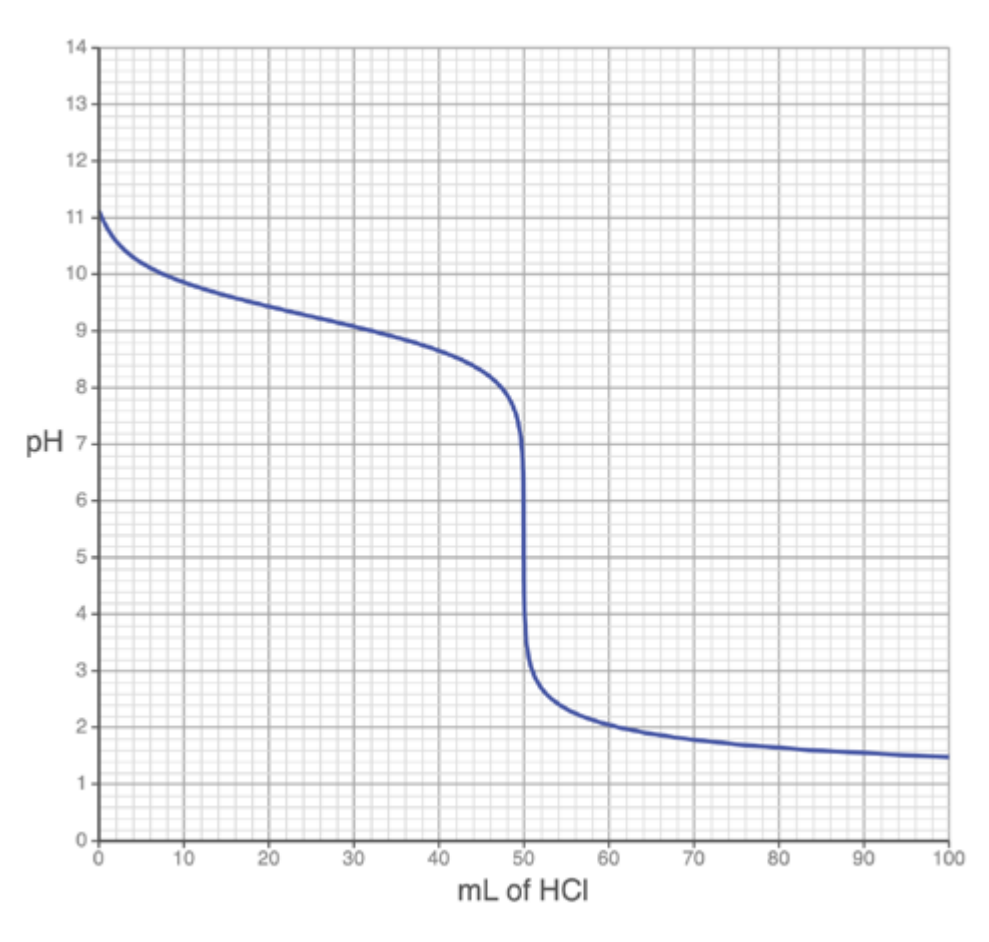
Question 21
1.0 pts

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? $K_a = 2.4 \times 10^{-7}$ for the unknown acid HZ

a. 9.86
b. 10.1
c. 7.00
d. 4.14

Question 22
1.0 pts

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



a. 7.0
b. 9.2
c. 3.4
d. 1.8
e. 5.5

Question 23
1.0 pts

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

a. a strong base titrated with a weak acid
b. a weak base titrated with a strong acid
c. a strong base titrated with a strong acid
d. a weak base titrated with a weak acid

Question 24
1.0 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?

a. 5 < pH < 7
b. 6 < pH < 8
c. 4 < pH < 6
d. 3 < pH < 5

Question 25
1.0 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?

a. orange
b. blue
c. yellow
d. green

Question 26
2.0 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?

a. there is no way to know
b. negative
c. positive
d. neutral

Question 27
1.0 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 $[CO_3^{2-}] = 0$)

a. 1.71×10^{-14}
b. 3.98×10^{-8}
c. 10.8
d. 0.0926

Question 28
2.0 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.

a. 0.963
b. 0.955
c. 2.05
d. 1.00