

HW06 - 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 $\text{Ca}(\text{OH})_2$ are needed to neutralize three moles of HCl ?

- 2
- 1
- 1.5
- 3

Question 3

1 pts

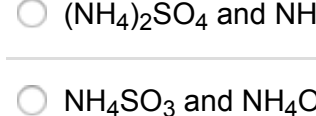
An aqueous solution is prepared with 2 moles of HCl and 1 mole of $\text{Ca}(\text{OH})_2$. The resulting solution contains mainly...

- 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:



- $3\text{H}^+ + 3\text{O}_2 + \text{H}_3\text{Li}_3$
- $\text{Li}_3\text{PO}_4 + 3\text{H}_2\text{O}$
- $\text{Li}_3\text{P} + 2\text{H}_2\text{O} + \text{H}_3\text{O}_5$
- $3\text{LiH} + (\text{OH})_3\text{PO}_4$

Question 5

1 pts

Identify the products of the following chemical reaction:



- $\text{Sr}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$
- $\text{SrNO}_3 + \text{H}_2\text{O}$
- $\text{Sr}(\text{NO}_2)_2 + 2\text{H}_2\text{O}_2$
- $\text{SrH}_2 + \text{HNO}_5$

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
- $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3 , respectively
- NH_4SO_3 and NH_4OH , respectively

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 $\text{C}_6\text{H}_5\text{NH}_2$ ($K_b = 4.3 \times 10^{-10}$) and 0.12 M $\text{C}_6\text{H}_5\text{NH}_3\text{Cl}$?

- 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? $K_a = 6 \times 10^{-6}$ 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 $(\text{NH}_4)_2\text{SO}_4$
- 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 $\text{Ca}(\text{OH})_2$ 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 ($(\text{CH}_3)_2\text{NH}$) and 0.400 M in dimethylamine hydrochloride ($(\text{CH}_3)_2\text{NH}_2\text{Cl}$)? K_b for dimethylamine = 7.4×10^{-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 100 mL of a buffer solution containing 0.600 molar formic acid (ionization constant = 1.8×10^{-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 ($K_b = 1.8 \times 10^{-5}$) 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?

- 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? $K_b = 1.8 \times 10^{-5}$ 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 $\text{HNO}_2(\text{aq})$ with 0.1 M $\text{KOH}(\text{aq})$? For HNO_2 , $K_a = 4.3 \times 10^{-4}$.

- 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 $\text{KOH}(\text{aq})$, calculate the pH after the addition of 55.0 mL of the base. For salicylic acid, $\text{p}K_a = 2.97$.

- 7.00
- 11.26
- 10.98
- 11.02

Question 18

1 pts

Consider the titration of 50.0 mL of 0.0200 M $\text{HClO}(\text{aq})$ with 0.100 M $\text{NaOH}(\text{aq})$. 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.
- $\text{pH} < 7$
- $\text{pH} > 7$
- $\text{pH} = 0$

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 ? $K_a = 2.4 \times 10^{-7}$ 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?

- $6 < \text{pH} < 8$
- $3 < \text{pH} < 5$
- $4 < \text{pH} < 6$
- $5 < \text{pH} < 7$

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 $\text{p}K_a$ 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 $[\text{HCO}_3^-] / [\text{H}_2\text{CO}_3]$ in blood? $K_{a1} = 4.30 \times 10^{-7}$ for H_2CO_3 . (Hint: Assume $[\text{CO}_3^{2-}] = 0$)

- 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 1.1×10^{-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
- 1.00
- 0.955
- 2.05