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McCord CH302

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MWF 2pm - 3pm

Exam 3

Fall 2018

Nov 7, 2018

Wednesday 7:30 - 9:00 PM

BUR 106

Remember to refer to the Periodic Table handout that is separate from this exam copy.

NOTE: Please keep this exam copy intact (all pages still stapled - including this cover page). You must turn in ALL the materials that were distributed. This means that you turn in your exam copy (name and signature included), bubble sheet, periodic table handout, and all scratch paper. Please also have your UT ID card ready to show as well.

This print-out should have 25 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 4.0 points

What is the molar solubility of CuBr in 0.5 M NaBr? The K_{sp} is 4.2×10^{-8}.

1. 4.20×10^{-7}

2. 4.20×10^{-8}

3. 8.40×10^{-8}

4. 3.48×10^{-3}

5. 2.05×10^{-4}

002 4.0 points

What is the molar solubility of $Zn(OH)_2$ in a solution buffered at pH of 8.0?
($Zn(OH)_2$, $K_{sp} = 3.0 \times 10^{-17}$)

1. 3.0×10^{-5}

2. 2.0×10^{-6}

3. 5.0×10^{-6}

4. 8.0×10^{-4}

5. 4.0×10^{-9}

003 4.0 points

A metal hydroxide has the general formula, $M(OH)_3$, and a K_{sp} equal to 3.5×10^{-24}. Enough of the compound is added to water such that the solution is saturated. What is the pH of this solution?

1. 8.63

2. 9.14

3. 8.07

4. 7.00

5. 7.42

6. 7.80

7. 8.95

8. 6.22

9. 5.74

10. 8.26

004 4.0 points

An indicator changes from red to blue going from its acidic (nonionized) form to its basic (ionized) form. The indicator has a K_a of 3.2×10^{-5}. What color would be visible in a solution with this indicator at pH 5.62?

1. blueish-purple

2. blue

3. purple

4. red

5. reddish-purple

005 4.0 points

50.0 mL of an HCl solution with a pH of 3.5 neutralizes 200.0 mL of a $Ca(OH)_2$ solution. What is the molarity of the $Ca(OH)_2$ solution?

1. 3.95×10^{-5} M

2. 0.0342 M

3. 4.55×10^{-6} M

4. 1.69 M

5. 1.78×10^{-4} M

6. 7.91×10^{-5} M

7. 14.3 M

8. 2.11×10^{-5} M

9. 1.58×10^{-4} M

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006 4.0 points

What is the pH of a solution containing 100 mL of 0.5 M NH_3 and 300 mL of 0.1 M HCl? The pK_b of ammonia is 4.75.

1. 8.551

2. 7.000

3. 9.074

4. 4.574

5. 9.949

6. 4.926

7. 9.426

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007 4.0 points

If a small amount of a strong base is added to a buffer made up of a weak acid HA and the sodium salt of its conjugate base NaA, the pH of the buffer solution does not change appreciably because

1. the strong base reacts with HA to give AOH and H^+.

2. the strong base reacts with HA to give A^-, a weak base.

3. the strong base reacts with A^- to give HA, a weak acid.

4. the K_a of HA is changed.

5. no reaction occurs.

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008 4.0 points

Consider the K_{sp} values of the following salts and indicate which of these is least soluble in water.

1. AB_4 $K_{sp} = 1 \times 10^{-35}$

2. AB_3 $K_{sp} = 1 \times 10^{-24}$

3. AB $K_{sp} = 1 \times 10^{-8}$

4. AB_2 $K_{sp} = 1 \times 10^{-15}$

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009 4.0 points

Which of the following shows the right equation for the ion product of lead(II) chlorate, $Pb(ClO_3)_2$?

1. $[Pb^{2+}][ClO_3^-]$

2. $[Pb^{2+}][ClO_3^-]^2$

3. $[Pb^{2+}](2 * [ClO_3^-])^2$

4. $[Pb^{2+}]^2[ClO_3^-]$

5. $[Pb^{2+}]^2[ClO_3^-]^2$

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010 4.0 points

Which of the following would be equal to K_{a3} for orthocarbonic acid, H_4CO_4?

1. $\frac{[H_2CO_4^{2-}]}{[H^+]\cdot[HCO_4^{3-}]}$

2. $\frac{[H^+]\cdot[HCO_4^{3-}]}{[H_2CO_4^{2-}]}$

3. $\frac{[H_4CO_4]}{[H^+]^3\cdot[HCO_4^{3-}]}$

4. $\frac{[H^+]^3\cdot[HCO_4^{3-}]}{[H_2CO_4^{2-}]}$

5. $\frac{[H^+]^3\cdot[HCO_4^{3-}]}{[H_4CO_4]}$

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011 4.0 points

For a triprotic acid, H_3A, with pK_a values of 2.5, 6.5 and 10.5, what species is present in highest concentration when 1M H_3A is buffered at pH 7?

1. H_2A^-

2. A^{3-}

3. HA^{2-}

4. H^+

5. H_3A

012 4.0 points

Which of the following indicators would be most suitable for the titration of 0.10 M $(CH_3)_3N$ ($K_b = 6.5 \times 10^{-5}$) with 0.10 M HCl? Transition ranges in pH units are given in parentheses after the indicator name.

1. chlorophenol red (4.8 - 6.4)

2. bromocresol green (3.8 - 5.4)

3. thymol blue (1.2 - 2.8)

4. phenolphthalein (8.0 - 9.6)

5. alizarin yellow (10.1 - 12.0)

6. bromothymol blue (6.0 - 7.6)

013 4.0 points

What is the pH of a solution which is 0.600 M in dimethylamine ($(CH_3)_2NH$) and 0.400 M in dimethylamine hydrochloride $\left((CH_3)_2NH_2^+Cl^-\right)$? K_b for dimethylamine = 7.4×10^{-4}.

1. 11.05

2. 2.95

3. 10.69

4. 10.87

5. 10.78

6. 3.31

7. 11.21

014 4.0 points

Consider 0.7 L of a buffer composed of 0.4 M HClO and 0.5 M NaClO? How many moles of strong base could this buffer withstand?

1. 0.28

2. 0

3. 0.4

4. 0.35

5. 0.5

015 4.0 points

What will be the pH at the equivalence point of a titration of 0.5 M acrylic acid with an equimolar solution of NaOH? Acrylic acid has a K_a of 5.6×10^{-5}.

1. 8.97

2. Not enough information is given.

3. 11.57

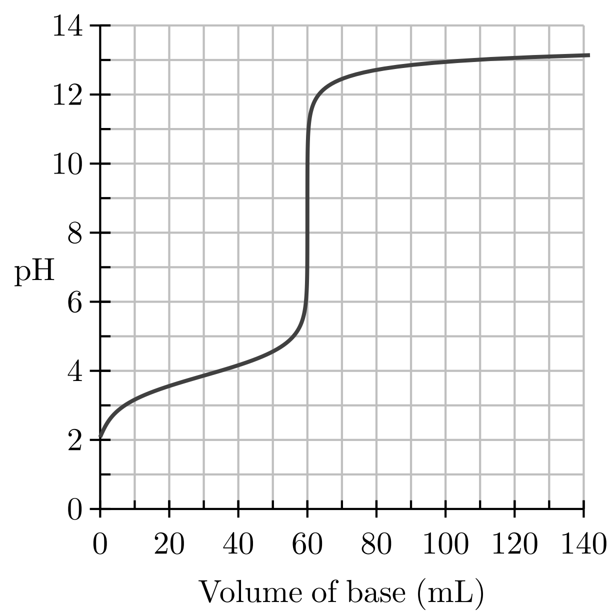
4. 8.82

5. 7.00

6. 5.18

016 4.0 points

Consider the following titration curve and data table.



Acid	pKa
pyruvic	2.50
lactic	3.86
acetic	4.74
aconitic	1.84

What is the identity of the analyte?

1. aconitic

2. pyruvic

3. lactic

4. acetic

017 4.0 points

The solubility product constant of barium sulfite ($BaSO_3$) is 8.0×10^{-7}. Will a precipitate of $BaSO_3$ form if 100 mL of a 4.0×10^{-4} molar solution of $BaCl_2$ is added to 100 mL of a 3.0×10^{-3} molar solution of Na_2SO_3?

1. yes, because the solubility product constant is exceeded

2. yes, because the solubility product constant is not exceeded

3. no, because the solubility product constant is not exceeded

4. no, because the solubility product constant is exceeded

018 4.0 points

The K_{sp} of $Cd_3(PO_4)_2$ at 18 ^oC is 1.08×10^{-33}. What is its molar solubility at this temperature?

1. 3.3×10^{-17} M

2. 1.0×10^{-7} M

3. 6.5×10^{-11} M

4. 2.5×10^{-9} M

019 4.0 points

A solution in equilibrium with solid barium phospate ($Ba_3(PO_4)_2$) is found to have a barium ion concentration of 0.0005 M and a K_{sp} of 3.4 x 10^{-23}. Calculate the concentration of phosphate ion.

1. 1.3x10^{-7}

2. 1.04x10^{-6}

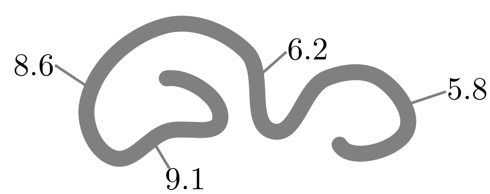
3. 5.2x10^{-7}

4. 2.6x10^{-7}

5. 2.7x10^{-13}

020 4.0 points

Consider the diagram below that represents a protein chain. The four positions shown with numbers are the pK_a's of the carboxylic acid residues in the chain. If the protein is in a pH 7.4 buffer, what is the combined total charge on those four side chains?



1. −2

2. +3

3. +2

4. −1

5. 0

6. −3

7. +1

8. −4

9. +4

021 4.0 points

What will be the molar ratio of SALT : ACID (in nice WHOLE numbers) of sodium hypochlorite (SALT) and hypochlorous acid ($K_a = 3.5 \times 10^{-8}$) in a solution with a pH of 7.058?

1. 4 : 1

2. 7 : 2

3. 2 : 3

4. Correct ratio is not shown.

5. 1 : 3

6. 1 : 2

7. 9 : 2

8. 2 : 5

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022 4.0 points

What is K_{sp} for HgI_2, if its molar solubility is 2.2×10^{-10} mol/L?

1. 1.4×10^{-21}

2. 6.9×10^{-11}

3. 4.7×10^{-30}

4. 8.3×10^{-8}

5. 5.2×10^{-25}

6. 1.7×10^{-14}

7. 4.3×10^{-29}

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023 4.0 points

A 100 mL buffer solution initially has 1.00 M HClO ($K_a = 3.0 \times 10^{-8}$) and 0.75 M NaClO. What is the new pH when this 100 mL of 0.10 M NaOH is added to the initial buffer solution?

1. 7.50

2. 9.52

3. 11.00

4. 10.71

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024 4.0 points

Which of the following mixtures would produce a buffer?

I) 100 mL of 0.1 M NH_4Cl + 75 mL of 0.1 M NaOH
II) 100 mL of 0.1 M NH_3 + 100 mL of 0.5 M HCl
III) 100 mL of 0.1 M NaCl + 50 mL of 0.2 M HCl
IV) 100 mL of 0.1 M $HClO_2$ + 100 mL of 0.1 M $NaClO_2$
V) 100 mL of 0.1 M NH_3 + 75 mL of 0.1 M NaOH

1. I, IV, and V only

2. I, II, III, and IV only

3. I and IV only

4. II and III only

5. I only

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025 4.0 points

You have been asked to create a buffer with a pH of 8.2. Which of these chemicals would you choose? You also have sodium hydroxide and hydrochloric acid to use as needed.

1. Formic acid $K_a = 1.77 \times 10^{-4}$

2. Propionic acid $K_a = 1.34 \times 10^{-5}$

3. Pyridine $K_b = 1.79 \times 10^{-9}$

4. Ammonia $K_b = 1.80 \times 10^{-5}$

5. Hypobromous acid $K_a = 2.00 \times 10^{-9}$