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CHEMISTRY WORKSHEET

BUFFER SOLUTIONS

Course: SCH4U Grade 12 Chemistry

DOWNLOAD FULL WORKSHEET

50 Practice Problems with Answers and Detailed Solutions

FULL worksheet contains 50 representative problems on:

✓ conjugate acid-base pairs, ✓ Henderson-Hasselbalch calculations, ✓ buffer preparation, ✓ weak acid or weak base buffers, ✓ added strong acid or base, ✓ buffer capacity, ✓ titration buffer regions

All problems are designed to reflect style and difficulty commonly seen on quizzes, tests, and final exams. Detailed solutions are included to help students understand the reasoning behind every step.

PART A - FUNDAMENTAL PROBLEMS
Problems 1-15. Simple calculations and basic applications

PART B - INTERMEDIATE PROBLEMS
Problems 16-30. Typical unit test questions involving multiple steps

PART C - ADVANCED PROBLEMS
Problems 31-40. More challenging calculations requiring deeper understanding

PART D - CHALLENGE PROBLEMS
Problems 41-50. Difficult exam-style questions combining multiple concepts

SUITABLE FOR:
quizzes, unit tests and final exam preparation

Section 1 Essential Information

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Section 2 Practice Problems

Part A - Buffer Foundations and Direct pH Calculations

8. A buffer contains equal concentrations of NH_3 and NH_4^+. The pK_b of NH_3 is 4.75. Calculate the pH

Part B - Preparing Buffers and Stoichiometric Formation

16. Calculate the pH of a buffer containing 0.100 mol CH_3COOH and 0.150 mol CH_3COO^-. Use pK_a = 4.74

Part C - Adding Strong Acid or Strong Base to a Buffer

32. A buffer contains 0.100 mol HA and 0.100 mol A^-. The pK_a is 4.74. Calculate the pH after 0.0100 mol NaOH is added

Part D - Mixed Unit Test Style Buffer Problems

45. A 1.000 L buffer contains 0.250 mol/L CH_3COOH and 0.150 mol/L CH_3COO^-. Then 0.200 mol HCl is added. Use pK_a = 4.74. Calculate the final pH assuming final volume is 1.000 L

Section 3 Solutions

Problem 8 Solution

Given: pK_b = 4.75, $nNH_4^+/nNH_3 = 1.00$

Method: For a weak base buffer, first calculate pOH, then convert to pH

Calculations:

$pOH = pK_b + \log(nBH^+/nB)$

$pOH = 4.75 + \log(1.00) = 4.75$

$pH = 14.00 - 4.75 = 9.25$

Final answer: pH = 9.25

Problem 16 Solution

Given: $nCH_3COOH = 0.100$ mol, $nCH_3COO^- = 0.150$ mol, $pK_a = 4.74$

Method: Use mole ratio in the Henderson-Hasselbalch equation

Calculations:

$pH = 4.74 + \log(0.150/0.100)$

$pH = 4.74 + \log(1.50) = 4.916$

Final answer: pH = 4.92

Problem 32 Solution

Given: nHA = 0.100 mol, nA^- = 0.100 mol, nNaOH = 0.0100 mol, $pK_a = 4.74$

Method: Added OH^- consumes HA and produces A^-

Calculations:

After NaOH: nHA = 0.100 - 0.0100 = 0.0900 mol

After NaOH: nA^- = 0.100 + 0.0100 = 0.110 mol

$pH = 4.74 + \log(0.110/0.0900) = 4.827$

Final answer: pH = 4.83

Problem 45 Solution

Given: nCH_3COOH = 0.250 mol, nCH_3COO^- = 0.150 mol, nHCl = 0.200 mol, final volume = 1.000 L

Method: First check whether added strong acid exceeds the amount of conjugate base

Calculations:

HCl consumes all 0.150 mol CH_3COO^-

Excess H^+ = 0.200 - 0.150 = 0.0500 mol

$[H^+]$ from excess strong acid = 0.0500 mol/1.000 L = 0.0500 mol/L

pH = -log(0.0500) = 1.301

Final answer: pH = 1.30; buffer capacity is exceeded

Section 4 Answer Key

Problem	Final Answer	Problem	Final Answer
8	pH = 9.25		
16	pH = 4.92		
32	pH = 4.83		
45	pH = 1.30; capacity exceeded		