Buffers

You will need to use Tables of K_a and K_b values to answer these questions. Tables like those given with the exams are included at the end of this document.

For more buffer questions, see the "Exam 2 A Questions" study guide.

1. What is the pH of a buffer containing 0.20 M H_2CO_3 and 0.10 M $NaHCO_3$? [fall 01, ex 2]

   (a)6.37 (b) 9.95 (c) 10.25 (d) 6.07 (e) 6.67

2. What ratio of NaF to HF is necessary to make a pH 3.90 buffer? [spr 01, ex 2]

   (a) 5.7 (b) 0.36 (c) 1.2 (d) 0.83 (e) 2.8

3. A chemist wants to make a pyridine (C_5H_5N)/pyridinium ($C_5H_5NH^+$) buffer that has a pH of 5.50. What is the ratio of $[C_5H_5N]/[C_5H_5NH^+]$ needed to make this buffer? [fall 00, ex 2]

   (a) 8.5 (b) 1.8 (c) 0.11 (d) 0.56 (e) 0.90

4. What is the pH of a buffer solution containing 0.30 M NH_3 and 0.10 M NH_4Cl? [spr 00, ex 2]

   (a) 8.77 (b) 9.25 (c) 9.73 (d) 5.22 (e) 4.26

5. You want to make a pH = 9.00 NH_3/NH_4^+ buffer. How many grams of NH_4Cl (s) do you need to add to 1.0 L of a 0.10 M NH_3 solution to make this buffer. (Assume the volume doesn't change upon addition of the NH_4Cl.) MW of NH_4Cl = 53.49 g/mol.[spr 00, ex 2]

   (a) 2.9 g (b) 5.6 g (c) 0.18 g (d) 3.8 g (e) 9.6 g

6. For what pH range could you use a mixture of KH_2PO_4 and K_2HPO_4 to make a buffer solution? [Fall 02, ex 2]

   (a) pH 2.12 - 12.32 (b) pH 1.12 - 3.12 (c) pH 11.32 - 13.32
   (d) pH 7.21 - 9.21 (e) pH 6.21-8.21

7. Which **one** of the following conjugate acid-base pairs would be the **best** choice to make a pH 3.0 buffer? [Spring 02, ex 2]

(a) H_2CO_3 / $NaHCO_3$
(b) CH_3CO_2H / $Na[CH_3CO_2]$
(c) $NaHSO_4$ / Na_2SO_4
(d) $ClCH_2CO_2H$ / $Na[ClCH_2CO_2]$
(e) H_3BO_3 / NaH_2BO_3

Answers: 1 d, 2 e, 3 b, 4 c, 5 e, 6 e, 7 d.

ADDITIONAL INFORMATION

Some K_a Values at 25 °C

	K_{a1}	K_{a2}	K_{a3}
CH_3CO_2H	1.8×10^{-5}		
$C_6H_5CO_2H$	6.3×10^{-5}		
$ClCH_2CO_2H$	1.4×10^{-3}		
H_3BO_3	5.8×10^{-10}		
H_2CO_3	4.3×10^{-7}	5.6×10^{-11}	
HNO_2	4.5×10^{-4}		
H_3PO_4	7.5×10^{-3}	6.2×10^{-8}	4.8×10^{-13}
H_2SO_4	very large	1.2×10^{-2}	
HF	3.5×10^{-4}		

Some K_b values at 25 °C

	K_b
NH_3	1.8×10^{-5}
CH_3NH_2	3.7×10^{-4}
$CH_3CH_2NH_2$	6.4×10^{-4}
C_5H_5N	1.8×10^{-9}
$C_5H_{11}N$	1.3×10^{-3}
$C_6H_5NH_2$	4.0×10^{-10}