AP Chemistry

Exercise 15.3a
Invader Problems

Name: _____

Date: _____ Per: _____

Table 14.2 | Values of K_a for Some Common Monoprotic Acids

Formula	Name	Value of K_a*
HSO_4^-	Hydrogen sulfate ion	1.2×10^{-2}
$HClO_2$	Chlorous acid	1.2×10^{-2}
$HC_2H_2ClO_2$	Monochloracetic acid	1.35×10^{-3}
HF	Hydrofluoric acid	7.2×10^{-4}
HNO_2	Nitrous acid	4.0×10^{-4}
$HC_2H_3O_2$	Acetic acid	1.8×10^{-5}
$[Al(H_2O)_6]^{3+}$	Hydrated aluminum(III) ion	1.4×10^{-5}
HOCl	Hypochlorous acid	3.5×10^{-8}
HCN	Hydrocyanic acid	6.2×10^{-10}
NH_4^+	Ammonium ion	5.6×10^{-10}
HOC_6H_5	Phenol	1.6×10^{-10}

↑ Increasing acid strength

*The units of K_a are customarily omitted.

Table 14.3 | Values of K_b for Some Common Weak Bases

Name	Formula	Conjugate Acid	K_b
Ammonia	NH_3	NH_4^+	1.8×10^{-5}
Methylamine	CH_3NH_2	$CH_3NH_3^+$	4.38×10^{-4}
Ethylamine	$C_2H_5NH_2$	$C_2H_5NH_3^+$	5.6×10^{-4}
Aniline	$C_6H_5NH_2$	$C_6H_5NH_3^+$	3.8×10^{-10}
Pyridine	C_5H_5N	$C_5H_5NH^+$	1.7×10^{-9}

1. Calculate the pH of each of the following solutions.
   a. 0.100 M propanoic acid ($HC_3H_5O_2$, $K_a = 1.3 \times 10^{-5}$)

   b. 0.100 M sodium propanoate ($NaC_3H_5O_2$)

   c. pure H_2O

   d. a mixture containing 0.100 M $HC_3H_5O_2$ and 0.100 M $NaC_3H_5O_2$.

Exercise 15.3a
Invader Problems

Name: _____

Date: _____ Per: _____

2. Calculate the pH after 0.020 mole of HCl is added to 1.00 L of each of the four solutions in Problem #1.

a.
b.
c.
d.

3. Calculate the pH after 0.020 mole of NaOH is added to 1.00 L of each of the four solutions in Problem #1.

a.
b.
c.
d.

Exercise 15.3a
Invader Problems

Name: _____

Date: _____ Per: _____

4. Calculate the pH after 0.010 mole of gaseous HCl is added to 250.0 mL of each of the following buffered solutions.
   a. 0.050 M NH_3/0.15 M NH_4Cl

   b. 0.50 M NH_3/1.50 M NH_4Cl

   Do the two original buffered solutions differ in their pH or their capacity? What advantage is there to having a buffer with a greater capacity?

5. Calculate the pH of a solution that is 0.40 M H_2NNH_2 and 0.80 M $H_2NNH_3^+$. In order for this buffer to have pH = pK_a, would you add HCl or NaOH? What quantity (moles) of which reagent would you added to 1.0 L of the original buffer solution so that the resulting solution has pH = pK_a? (K_b of H_2NNH_2 = 1.3 x 10^{-6})