Chem 10123, Quiz 3 **Answer Key**
February 12, 2020

1. (4 points) For each of the following substances, indicate whether it would be acidic (**A**), basic (**B**), or neutral (**N**) in aqueous solution.

KOCl B CH_3NH_3Br A HOCl A

$(CH_3)_2NH$ B KNO_3 N N_2O_5 A

2. (2 points) Regarding the $CH_3NH_3Br_{(aq)}$ solution above, write the ***balanced net ionic equation*** for the essential ***equilibrium reaction*** that accounts for your answer.

$$CH_3NH_3^+(aq) + H_2O \rightleftharpoons H_3O^+(aq) + CH_3NH_2(aq)$$

3. Barium nitrite, $Ba(NO_2)_2$ (molar mass = 229.35) dissolves in water to yield a ***basic*** solution.

(a) (3 points) Why is the solution basic? Explain in 30 words or less and write the ***balanced net ionic equation*** that accounts for this fact.

Nitrite ion NO_2^- is the conjugate base of a weak acid HNO_2. Thus, NO_2^- functions as a weak base by reacting with H_2O to form the conjugate acid and OH^- ion as follows.

$$NO_2^-(aq) + H_2O \rightleftharpoons HNO_2(aq) + OH^-(aq)$$

(b) (3 points) **SHOW ALL WORK.** Determine the mass of $Ba(NO_2)_2$ that is required to prepare 300.0 mL of 0.150 M $Ba(NO_2)_2$.

(0.3000 L) (0.150 mole $Ba(NO_2)_2$ / L) (229.35 g/mole) = 10.3 g $Ba(NO_2)_2$

(c) (8 points) **SHOW ALL WORK.** ***Clearly state and justify any assumptions that you may make.*** Determine the pH of this 0.150 M $Ba(NO_2)_2$ solution. (For HNO_2, $pK_a = 3.34$)

(= 0.300 M NO_2^-)

	$NO_2^-(aq)$ + H_2O ⇌	$HNO_2(aq)$ +	$OH^-(aq)$
I	0.300 M	0	0
C	- x	+ x	+ x
E	0.300 - x	x	

$K_b = K_w / K_a = 10^{-14} / 10^{-3.34} = 2.19 \times 10^{-11}$

$K_b = [HNO_2][OH^-] / [NO_2^-]$

$2.19 \times 10^{-11} = x^2 / (0.300 - x)$ (since K_b is very small, assume $x << 0.300$)

$2.19 \times 10^{-11} \approx x^2 / (0.300)$

$x = [OH^-] \approx 2.562 \times 10^{-6}$ (assumption is OK!)

$pOH = -\log(2.562 \times 10^{-6}) = 5.59$

$pH = 14.00 - pOH = 14.00 - 5.59 = 8.41$ (a basic solution!)