Chem 112 Spring 2020 Quiz 6 Whelan

SID | | | | | | | | | Last Key First Answer

Question 1 (2 Points)

In the laboratory, a general chemistry student measured the **pH** of a **0.312 M** aqueous solution of **nitrous acid** to be 1.854 What is the **Ka** for HNO_2?

	HNO_2		H_2O	$\rightleftharpoons$	H_3O^+		NO_2^-
I	0.312				0		0
C	$-x$				x		x
E	$.312-x$		↓		x		x

$\log_{10}[H_3O^+] = -1.854$

$[H_3O^+] = 0.014 = x$

$K_a = \frac{[H_3O^+][NO_2^-]}{[HNO_2]}$

$K_a = \frac{(0.014)(0.014)}{0.312-0.014}$

Ka = 6.58×10^{-4}

Question 2 (2 Points)

Calculate the pH of a **0.267 M** aqueous solution of **caffeine** ($C_8H_{10}N_4O_2$, $K_b = 4.1\times10^{-4}$).

	B		H_2O	$\rightleftharpoons$	BH^+		OH^-
I	0.267				0		0
C	$-x$				x		x
E	$.267-x$		↓		x		x

$0.267 > 100\,K_b$

$\therefore 0.267-x \approx 0.267$

$x = \sqrt{0.267(4.1\times10^{-4})}$

$x = 1.046\times10^{-2} = [OH^-]$

$pOH = -\log_{10} 1.046\times10^{-2} = 1.98$

$pH = 14 - 1.98$

pH = 12.02

Question 3 (2 Points)

Indicate whether each of the following compounds will give an **acidic**(A), **basic**(B) or **neutral**(N) solution when dissolved in water.

ammonium nitrate: A

lithium nitrate: N

sodium acetate: B

potassium nitrite: B

Question 4 (4 Points)

The substance **benzoic acid** (C_6H_5COOH) is a weak acid ($K_a = 6.30\times10^{-5}$).
What is the **pH** of a **0.246 M** aqueous solution of **sodium benzoate**, (NaC_6H_5COO)?

	$C_6H_5COO^-$	+	H_2O	$\rightleftharpoons$	C_6H_5COOH	+	OH^-
I	0.246				0		0
C	$-x$				x		x
E	$.246-x$		↓		x		x

$K_{C_6H_5COO^-} = \frac{1\times10^{-14}}{6.30\times10^{-5}} = 1.59\times10^{-10}$

$0.246 > 100(1.59\times10^{-10})$

$\therefore 0.246-x \approx 0.246$

$x = \sqrt{0.246(1.59\times10^{-10})}$

$x = 6.254\times10^{-6} = [OH^-]$

$pOH = -\log_{10} 6.254\times10^{-6} = 5.20$

$pH = 14 - 5.20$

pH = 8.80