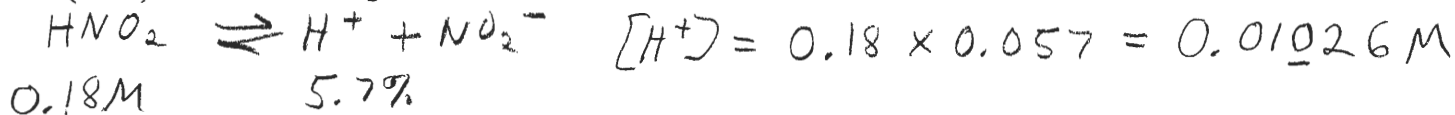


1. (3 Pts) A 0.18 M HNO<sub>2</sub> solution is 5.7% ionized. Calculate the H<sup>+</sup> ion concentration.



2. (6 Pts) 50.00 mL of 0.10 M HNO<sub>2</sub> (nitrous acid) was titrated with 0.10 M NaOH solution. Determine the pH in the titration flask after 25.00 mL of NaOH solution was added. (Given K<sub>a</sub> = 4.5 x 10<sup>-4</sup>)

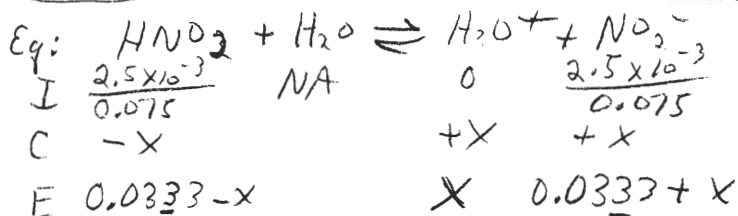


① moles Acid (weak)  $\frac{50.00 \text{ mL} \times 0.10 \text{ mol HNO}_2}{1000 \text{ mL}} = 5.0 \times 10^{-3} \text{ mol HNO}_2$

② moles Base (strong)  $\frac{25.00 \text{ mL} \times 0.10 \text{ mol NaOH}}{1000 \text{ mL}} = 2.5 \times 10^{-3} \text{ mol OH}^-$

③ subtraction

(and)  $2.5 \times 10^{-3} \text{ mol XS w/ Acid (HNO}_2)$   
 $2.5 \times 10^{-3} \text{ mol NO}_2^- \text{ ions formed}$

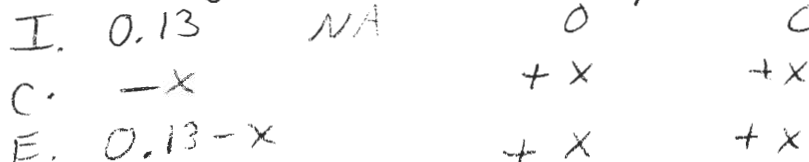
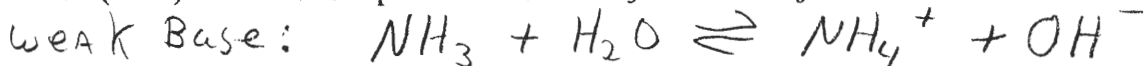


$$K_a = \frac{[x][0.0333 + x]}{[0.0333 - x]} = 4.5 \times 10^{-4}$$

$$K_a \approx x \approx 4.5 \times 10^{-4} = [\text{H}^+]$$

pH = 3.35

3. (6 Pts) Calculate the pH of a 0.13 M NH<sub>3</sub> solution. K<sub>b</sub> = 1.8 x 10<sup>-5</sup>.

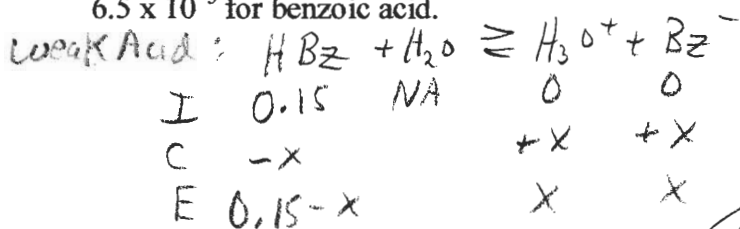


$$K_b = \frac{x^2}{0.13 - x}$$

$$x = 1.53 \times 10^{-3} = [\text{OH}^-] \quad \leftarrow \text{Prop?}$$

pOH = 2.82      pH = 11.18

4. (6 Pts) Calculate the pH of 100.0 mL of 0.15 M benzoic acid (HC<sub>6</sub>H<sub>5</sub>CO<sub>2</sub>) solution. Given K<sub>a</sub> = 6.5 x 10<sup>-5</sup> for benzoic acid.



$$K_a = \frac{x^2}{0.15 - x} \quad \leftarrow \text{Prop?}$$

$$x = 0.00312 = [\text{H}^+]$$

pH = 2.51

5. (4 Pts) Identify all acid-base conjugate pairs.

