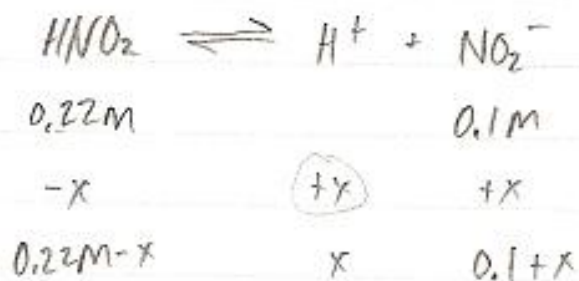


Problem and Conceptually Accurate Solution

① How many moles NaOH are required to change the pH of 100 mL of buffer made from 0.1 M NaNO_2 + 0.22 M HNO_2 to pH = 4?



$$4.0 = 3.35 + \log \frac{(0.1\text{M} + x)}{(0.22\text{M} - x)}$$

$$.65 = \log \frac{(0.1\text{M} + x)}{(0.22\text{M} - x)}$$

$$10^{.65} = \frac{(0.1\text{M} + x)}{(0.22\text{M} - x)}$$

$$4.47x + .983 = 0.1 + x$$

$$.883 = 5.47x$$

$$x = 0.161\text{M OH}^-$$

$$\frac{0.161\text{ mol}}{\text{L}} \times 0.1\text{L} = 0.0161\text{ mol OH}^-$$