

## Answer on Question #54858 – Chemistry – Physical chemistry

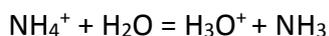
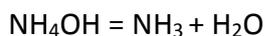
### Question:

In a buffer solution the ratio of concentration of  $\text{NH}_4\text{Cl}$  and  $\text{NH}_4\text{OH}$  is 1:1 when it changes in 2:1 what will be the value of pH of buffer? and how?

(1) Increase; (2) Decrease; (3) No change

### Solution

There are the following ionic equilibria in a buffer solution:



conjugated acid

conjugated base

The value of pH of a buffer solution can be calculated using the following equation

$$\text{pH} = \text{pK}_a(\text{acid}) - \lg \frac{C_{\text{acid}}}{C_{\text{base}}}$$

$$K_a \text{ for } \text{NH}_4\text{Cl} = 5.6 \times 10^{-10}$$

If the ratio of concentration of  $\text{NH}_4\text{Cl}$  and  $\text{NH}_4\text{OH}$  is 1:1 then

$$\text{pH} = -\lg(5.6 \times 10^{-10}) - \lg(1/1) = 9.25$$

If the ratio of concentration of  $\text{NH}_4\text{Cl}$  and  $\text{NH}_4\text{OH}$  is 2:1 then

$$\text{pH} = -\lg(5.6 \times 10^{-10}) - \lg(2/1) = 8.95$$

So, the pH will decrease.

**Answer: (2) Decrease**