#36342, Inorganic Chemistry

If equal volumes of HCl clout ions whose pH is 2 and 0.03 M NaOH
solution are mixed;what will be the pH of the resulting solution?

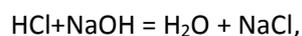## Solution

The pH of a solution is defined as the negative logarithm of the molar concentration of hydrogen
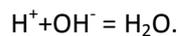ion: pH=-lg[H$^+$]. If we have solution with pH=2, it means that we have 0.01 mole of H$^+$ per liter:

2=-lg[H$^+$]; [H$^+$]=10^{-2}= 0.01 mol/L.

Also, we have 0.03 M NaOH solution, it means we have 0.03 mole of OH$^-$ per liter.

Following the equation of reaction between HCl and NaOH :

HCl+NaOH = H$_2$O + NaCl,

or in ionic form:

H$^+$+OH$^-$ = H$_2$O.

 we have an excess of NaOH: 0.03-0.01=0.02 mol/L.

Use the ion product = [H$^+$][OH$^-$]=10^{-14} to find [H$^+$]:

$$[H^+] = \frac{ion\,product}{[OH^-]} = \frac{1 \bullet 10^{-14}}{0.02} = 5 \bullet 10^{-13} \ .$$

Next, we can use the pH equation:

pH=-lg[H$^+$]=-lg(5·10^{-13})=12.3.

Answer: the pH of the resulting solution is 12.3.