Answer on Question #41127 - Chemistry – Other

Question:

pH values of 0.1 M HCL and 0.1 M CH_3COOH are

Answer:

1. pH equals:

$$pH = -lg [H^+]$$

HCl is a strong acid and it fully dissociates in water:

$$HCl_{(aq)} \leftrightarrow H^+_{(aq)} + Cl^-_{(aq)}$$

We see that concentration of HCl equals H^+ ion concentration. Therefore H^+ ion concentration is:

$$[H^+] = C(HCl) = 0.1 \text{ M} = 0.1 \text{ mol/L}$$

pH value of 0.1 M HCl is:

$$pH = -lg (0.1) = 1$$

2. Acetic acid CH_3COOH ionizes partially, so we need the pKa or Ka value of acetic acid. Dissociation of CH_3COOH:

$$CH_3COOH_{(aq)} \leftrightarrow H^+_{(aq)} + CH_3COO^-_{(aq)}$$

Ka is dissociation constant which is concentration of product/concentration of reactant:

$$Ka= [CH_3COO^-] * [H^+] / [CH_3COOH]$$

After partial dissociation, $[CH_3COOH]$ is still approximately 0.1M, and $[CH_3COO^-] = [H^+]$.

Ka of $CH_3COOH = 1.74 * 10^{-5}$ (from data book). Then H^+ ion concentration equals:

$$1.74 * 10^{-5} = [H^+]^2 / 0.1$$

$$[H^+]^2 = 1.74*10^{-5} * 0.1$$

$$[H^+]^2 = 1.74*10^{-6}$$

$$[H^+]= 1.32*10^{-3}$$

pH value of 0.1 M CH_3COOH is:

$$pH = -lg (1.32*10^{-3}) = 2.88$$

Answer: 1. pH = 1

2. pH = 2.88