Problems of Acid–base equilibria: Weak acids and bases

1) Calculate the degree of dissociation and the equilibrium constant K_b in an aqueous solution of ethylamine ($C_2H_5NH_2$) if pH = 12.254 and the concentration of base is 0.52 mol/L.

2) Find out the degree of dissociation and the equilibrium constant K_b in an aqueous solution of ammonia (NH_3) where pH = 11.394. The solution has 8 g of base and a volume of 1350 mL.
Atomic masses (g/mol): H = 1, N = 14.

3) Calculate pH and degree of dissociation in a solution of methylamine (CH_3NH_2) if its molarity is 0.12 mol/L.
Data: $K_b = 4.37\times10^{-4}$.

4) An aqueous solution has 14 g of acetic acid (CH_3COOH) and a volume of 550 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 1.80\times10^{-5}$.
Atomic masses (g/mol): H = 1, C = 12, O = 16.

5) Find out the pH and the molarity in an aqueous solution of nitrous acid (HNO_2) if its degree of dissociation is 4.42 %.
Data: $K_a = 4.50\times10^{-4}$.

6) An aqueous solution has 4 g of formic acid (HCOOH) and a volume of 1250 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 1.80\times10^{-4}$.
Atomic masses (g/mol): H = 1, C = 12, O = 16.

7) Calculate pH and degree of dissociation in a solution of methylamine (CH_3NH_2) if its molarity is 0.33 mol/L.
Data: $K_b = 4.37\times10^{-4}$.

8) An aqueous solution has 20 g of hypochlorous acid (HClO) and a volume of 1050 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 3.00\times10^{-8}$.
Atomic masses (g/mol): H = 1, O = 16, Cl = 35.5.

9) An aqueous solution has 2 g of hydrocyanic acid (HCN) and a volume of 1200 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 4.00\times10^{-10}$.
Atomic masses (g/mol): H = 1, C = 12, N = 14.

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10) An aqueous solution has 14 g of butanoic acid ($CH_3(CH_2)_2COOH$) and a volume of 1350 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 1.50\times10^{-5}$.
Atomic masses (g/mol): H = 1, C = 12, O = 16.

11) Calculate pH and degree of dissociation in a solution of methylamine (CH_3NH_2) if its molarity is 0.72 mol/L.
Data: $K_b = 4.37\times10^{-4}$.

12) An aqueous solution has 28 g of aniline ($C_6H_5NH_2$) and a volume of 1050 mL.Find out pH and degree of dissociation of the base.
Data: $K_b = 3.80\times10^{-10}$.
Atomic masses (g/mol): H = 1, C = 12, N = 14.

13) Calculate pH and equilibrium constant K_a in an aqueous solution of nitrous acid (HNO_2) if its degree of dissociation is 4.07 % and its concentration is 0.26 mol/L.

14) An aqueous solution has 5 g of formic acid (HCOOH) and a volume of 650 mL. Find out pH and degree of dissociation of the acid.
Data: $K_a = 1.80\times10^{-4}$.
Atomic masses (g/mol): H = 1, C = 12, O = 16.

15) Calculate pH and equilibrium constant K_b in an aqueous solution of methylamine (CH_3NH_2) if its degree of dissociation is 4.02 % and its molarity is 0.26 mol/L.

16) Find out pH and equilibrium constant K_b in an aqueous solution of aniline ($C_6H_5NH_2$) if its degree of dissociation is 3.73×10^{-3} %. The solution has 33 g of base and a volume of 1300 mL.
Atomic masses (g/mol): H = 1, C = 12, N = 14.

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Answers:

1) $\alpha = 3.45\ \%$, $K_b = 6.41\times10^{-4}$

2) $\alpha = 0.71\ \%$, $K_b = 1.77\times10^{-5}$

3) pH = 11.847, $\alpha = 5.86\ \%$

4) pH = 2.56, $\alpha = 0.6493\ \%$

5) 0.22 mol/L, pH = 2.012

6) pH = 2.462, $\alpha = 4.96\ \%$

7) pH = 12.072, $\alpha = 3.57\ \%$

8) pH = 3.982, $\alpha = 0.0288\ \%$

9) pH = 5.304, $\alpha = 8.05\times10^{-3}\ \%$

10) pH = 2.879, $\alpha = 1.12\ \%$

11) pH = 12.244, $\alpha = 2.43\ \%$

12) pH = 9.019, $\alpha = 3.64\times10^{-3}\ \%$

13) pH = 1.975, $K_a = 4.50\times10^{-4}$

14) pH = 2.268, $\alpha = 3.23\ \%$

15) pH = 12.019, $K_b = 4.37\times10^{-4}$

16) pH = 9.008, $K_b = 3.80\times10^{-10}$