

## Problems of Acid–base equilibria: Salt hydrolysis

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1) Find the molarity and the degree of hydrolysis in an aqueous solution of ammonium perchlorate ( $\text{NH}_4\text{ClO}_4$ ) if  $\text{pH} = 4.917$ .

*Data:*  $K_b(\text{NH}_3) = 1.77 \times 10^{-5}$ .

2) Calculate the pH and the degree of hydrolysis in an aqueous solution of ethylammonium iodide ( $\text{C}_2\text{H}_5\text{NH}_3\text{I}$ ) if its molarity is 0.17 mol/L.

*Data:*  $K_b(\text{C}_2\text{H}_5\text{NH}_2) = 6.41 \times 10^{-4}$ .

3) An aqueous solution has 9 g of methylammonium nitrate ( $\text{CH}_3\text{NH}_3\text{NO}_3$ ) and a volume of 950 mL. Calculate the pH and the degree of hydrolysis of this compound.

*Data:*  $K_b(\text{CH}_3\text{NH}_2) = 5.40 \times 10^{-4}$ .

*Molar mass:*  $\text{CH}_3\text{NH}_3\text{NO}_3 = 94 \text{ g/mol}$ .

4) We have prepared 1100 mL of an aqueous solution of potassium cyanide (KCN) whose pH is 11.308. Find out the mass of pure salt required.

*Data:*  $K_a(\text{HCN}) = 4.00 \times 10^{-10}$ .

*Molar mass:*  $\text{KCN} = 65.1 \text{ g/mol}$ .

5) We have prepared 700 mL of an aqueous solution of ethylammonium iodide ( $\text{C}_2\text{H}_5\text{NH}_3\text{I}$ ) whose pH is 5.721. Find out the mass of pure salt required.

*Data:*  $K_b(\text{C}_2\text{H}_5\text{NH}_2) = 6.41 \times 10^{-4}$ .

*Molar mass:*  $\text{C}_2\text{H}_5\text{NH}_3\text{I} = 172.9 \text{ g/mol}$ .

6) Find the molarity and the degree of hydrolysis in an aqueous solution of methylammonium iodide ( $\text{CH}_3\text{NH}_3\text{I}$ ) if  $\text{pH} = 6.055$ .

*Data:*  $K_b(\text{CH}_3\text{NH}_2) = 5.40 \times 10^{-4}$ .

7) Calculate the pH and the degree of hydrolysis in an aqueous solution of ethylammonium perchlorate ( $\text{C}_2\text{H}_5\text{NH}_3\text{ClO}_4$ ) if its molarity is 0.78 mol/L.

*Data:*  $K_b(\text{C}_2\text{H}_5\text{NH}_2) = 6.41 \times 10^{-4}$ .

8) Find the molarity and the degree of hydrolysis in an aqueous solution of sodium methanoate ( $\text{HCOONa}$ ) if  $\text{pH} = 8.772$ .

*Data:*  $K_a(\text{HCOOH}) = 1.80 \times 10^{-4}$ .

9) Find the molarity and the degree of hydrolysis in an aqueous solution of ethylammonium nitrate ( $\text{C}_2\text{H}_5\text{NH}_3\text{NO}_3$ ) if  $\text{pH} = 5.487$ .

*Data:*  $K_b(\text{C}_2\text{H}_5\text{NH}_2) = 6.41 \times 10^{-4}$ .

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### Answers:

- 1) 0.26 mol/L,  $\alpha_{\text{H}} = 4.66 \times 10^{-3} \%$
- 2) pH = 5.788,  $\alpha_{\text{H}} = 9.58 \times 10^{-4} \%$
- 3) pH = 5.865,  $\alpha_{\text{H}} = 1.36 \times 10^{-3} \%$
- 4) 12 g
- 5) 28 g
- 6) 0.042 mol/L,  $\alpha_{\text{H}} = 2.10 \times 10^{-3} \%$
- 7) pH = 5.457,  $\alpha_{\text{H}} = 4.47 \times 10^{-4} \%$
- 8) 0.63 mol/L,  $\alpha_{\text{H}} = 9.39 \times 10^{-4} \%$
- 9) 0.68 mol/L,  $\alpha_{\text{H}} = 4.79 \times 10^{-4} \%$