Buffer Solutions

① What is the pH of a buffer solution made by making up $1.00 dm^3$ of solution containing 1.00 mole of ethanoic acid and 1.00 mole of sodium ethanoate? Ka for ethanoic acid = $1.74 \times 10^{-5} mol dm^{-3}$

② Calculate the pH of a buffer solution made by dissolving 18.5g of propanoic acid, C_2H_5COOH, and 12.0g of sodium propanoate, C_2H_5COONa in water and then making the volume up to $250 cm^3$. pK_a for propanoic acid = 4.87.

③ A buffer solution was made by mixing $50.0 cm^3$ of $0.300 mol dm^{-3}$ of ethanoic acid with $100 cm^3$ of $0.600 mol dm^{-3}$ sodium ethanoate. Calculate its pH if ka for ethanoic acid is $1.74 \times 10^{-5} mol dm^{-3}$.

④ In question 1 you calculated the pH of a buffer solution which contained ethanoic acid and sodium ethanoate. The solution contained $1.00 mol dm^{-3}$ of each component. The pH turned out to be 4.76. What would be the effect of adding a) $1.00 cm^3$ of $10.0 mol dm^{-3}$ hydrochloric acid and b) $100 cm^3$ of $10.0 mol dm^{-3}$ sodium hydroxide to $1000 cm^3$ of the buffer solution? Ka for ethanoic acid = $1.74 \times 10^{-5} mol dm^{-3}$

(5) In what proportions should you mix ethanoic acid and sodium ethanoate in order to give a buffer solution of pH 5.00? pka for ethanoic acid = 4.76.

(6) Calculate the pH of a buffer solution containing 1.00 $moldm^{-3}$ of ammonia and 0.400 $moldm^{-3}$ ammonium chloride. Ka for the ammonium ion, NH_4^+ is 5.62×10^{-10} $moldm^{-3}$.

⑦ Calculate the effect on the pH of adding a) $5.00 cm^3$ of $10.0 mol dm^{-3}$ hydrochloric acid and b) $5.00 cm^3$ of $10.0 mol dm^{-3}$ sodium hydroxide solution to $1000 cm^3$ of the buffer solution from question 6.

⑧ In what proportions should ammonia and ammonium chloride be mixed in solution to give a buffer solution of pH 10.0? pka for NH_4^+ is 9.25.