HL Paper 1

Which mixtures act as buffer solutions?

I. $100\ \text{cm}^3\ 0.1\ \text{mol dm}^{-3}$ ethanoic acid and $100\ \text{cm}^3\ 0.1\ \text{mol dm}^{-3}$ sodium ethanoate

II. $100\ \text{cm}^3\ 0.1\ \text{mol dm}^{-3}$ ethanoic acid and $50\ \text{cm}^3\ 0.1\ \text{mol dm}^{-3}$ sodium hydroxide

III. $100\ \text{cm}^3\ 0.1\ \text{mol dm}^{-3}$ ethanoic acid and $100\ \text{cm}^3\ 0.5\ \text{mol dm}^{-3}$ sodium hydroxide

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

A buffer solution is formed by mixing equal volumes of $1.00\ \text{mol dm}^{-3}$ propanoic acid and $0.500\ \text{mol dm}^{-3}$ potassium propanoate.

What is the concentration, in mol dm^{-3}, of $[\text{H}^+(\text{aq})]$ in this buffer solution? (K_a for propanoic acid is 1.30×10^{-5}.)

A. 2.60×10^{-5}

B. 1.95×10^{-5}

C. 1.30×10^{-5}

D. 0.650×10^{-5}

The $\text{p}K_\text{a}$ of ethanoic acid is 4.8 at 298 K. Which combination will produce a buffer solution with a pH of 4.8 at 298 K?

A. $20.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{CH}_3\text{COOH}$ and $10.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{NaOH}$

B. $20.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{CH}_3\text{COOH}$ and $20.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{NaOH}$

C. $10.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{CH}_3\text{COOH}$ and $20.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{NaOH}$

D. $14.8\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{CH}_3\text{COOH}$ and $10.0\ \text{cm}^3$ of $1.0\ \text{mol dm}^{-3}\ \text{NaOH}$

Which mixture will form a buffer in aqueous solution?

A. $0.10\ \text{mol}\ \text{NH}_3 + 0.20\ \text{mol}\ \text{HCl}$

B. $0.10\ \text{mol}\ \text{NH}_3 + 0.20\ \text{mol}\ \text{NaOH}$

C. $0.10\ \text{mol}\ \text{NaOH} + 0.20\ \text{mol}\ \text{KCl}$

D. $0.20\ \text{mol}\ \text{NH}_3 + 0.10\ \text{mol}\ \text{HCl}$