

Strong and weak acids, pH and buffer solutions

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers conjugate pairs, pH calculations, weak acids, buffers and a titration curve. You have 45 minutes and may use a calculator. Show all working and give each pH to two decimal places.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB R3.1

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Acids and bases (3 marks)

Hydrogensulfate ions react with ammonia: $\text{HSO}_4^- + \text{NH}_3 \rightleftharpoons \text{SO}_4^{2-} + \text{NH}_4^+$.

- State what is meant by a Brønsted-Lowry acid. (1 mark)
- Identify the two conjugate acid-base pairs. (2 marks)

Question 2 pH of nitric acid (2 marks)

Calculate the pH of 0.0075 mol/dm³ nitric acid, a strong acid. Give your answer to 2 decimal places.

Question 3 pH of propanoic acid (3 marks)

A pupil in Kampala has 0.200 mol/dm³ propanoic acid, $K_a = 1.35 \times 10^{-5}$ mol/dm³.

- Write the expression for K_a . (1 mark)
- Calculate $[\text{H}^+]$ and the pH. (2 marks)

Question 4 Hydrocyanic acid buffer (2 marks)

A buffer contains 0.40 mol/dm³ hydrocyanic acid ($\text{p}K_a = 9.31$) and 0.10 mol/dm³ sodium cyanide. Calculate its pH.

Question 5 Buffer response to alkali (3 marks)

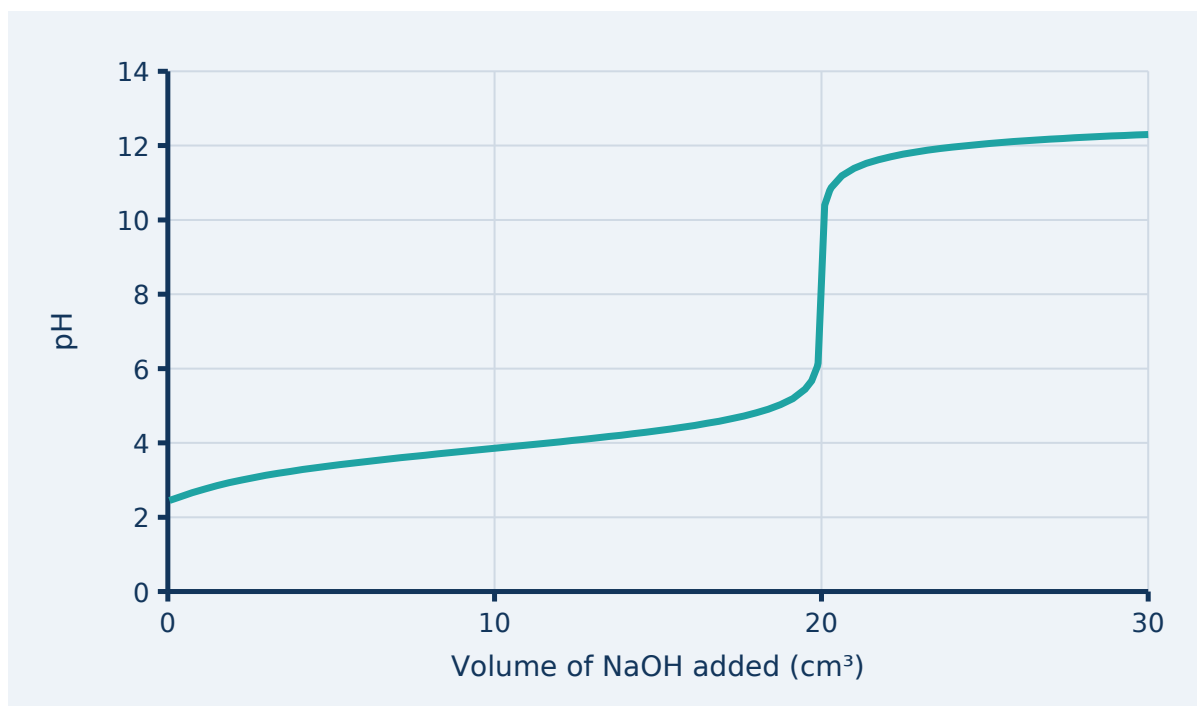
A buffer contains ethanoic acid and sodium ethanoate. Explain, with an equation, how it

keeps the pH almost constant when a small amount of sodium hydroxide is added.

Question 6 Titration of lactic acid (3 marks)

The graph shows the titration of 20.0 cm³ of lactic acid solution with 0.100 mol/dm³ NaOH.

- Read the equivalence volume and calculate the concentration of the lactic acid. (1 mark)
- Read the pH at half-equivalence, state pKa and calculate Ka. (2 marks)



Titration of lactic acid with NaOH.

Question 7 pH at equivalence (2 marks)

Explain why the pH at the equivalence point of the titration in the previous question is greater than 7.

Question 8 Strong against weak acid (2 marks)

0.10 mol/dm³ hydrochloric acid has pH 1.00 but 0.10 mol/dm³ ethanoic acid has pH 2.87. Explain the difference.