

AQA A2 Chemistry Worksheet

Acids and Bases - pH and Buffer Solutions | A2 Level | Spec Ref: 3.1.11.1



Student Name: _____

Date: _____

Total: 45 marks

1. [1 mark]

Define the term *pH*.

2. [2 marks]

Explain why the pH of a strong acid solution can be calculated directly from its concentration, whereas for a weak acid, an equilibrium constant is required.

3. [4 marks]

Calculate the pH of a $0.025 \text{ mol dm}^{-3}$ solution of nitric acid (HNO_3).

4.

[5 marks]

A student prepares a $0.100 \text{ mol dm}^{-3}$ solution of ethanoic acid (CH_3COOH). The K_a for ethanoic acid is $1.75 \times 10^{-5} \text{ mol dm}^{-3}$ at 298 K.

Calculate the pH of this ethanoic acid solution.

5.

[1 mark]

State the meaning of the term *buffer solution*.

6.

[3 marks]

Explain how a buffer solution made from a weak acid and its conjugate base resists a decrease in pH when a small amount of strong acid is added.

7. [4 marks]

A buffer solution is prepared by mixing 25.0 cm^3 of $0.200 \text{ mol dm}^{-3}$ propanoic acid ($\text{CH}_3\text{CH}_2\text{COOH}$) with 25.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ sodium propanoate ($\text{CH}_3\text{CH}_2\text{COONa}$). The K_a for propanoic acid is $1.30 \times 10^{-5} \text{ mol dm}^{-3}$.

Calculate the pH of this buffer solution.

8. [2 marks]

Explain why a buffer solution has a limited capacity to resist changes in pH.

9. [1 mark]

Write the expression for the ionic product of water, K_w .

10. [3 marks]

At 373 K , $K_w = 5.47 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$. Calculate the pH of pure water at this temperature.

11.

[5 marks]

A student titrates 25.0 cm^3 of $0.150 \text{ mol dm}^{-3}$ ethanoic acid (CH_3COOH) with $0.100 \text{ mol dm}^{-3}$ sodium hydroxide (NaOH). The K_a for ethanoic acid is $1.75 \times 10^{-5} \text{ mol dm}^{-3}$.

Calculate the pH of the solution after 10.0 cm^3 of NaOH has been added.

12.

[6 marks]

Consider the titration of 20.0 cm^3 of $0.100 \text{ mol dm}^{-3}$ ammonia (NH_3) with $0.100 \text{ mol dm}^{-3}$ hydrochloric acid (HCl). The K_b for ammonia is $1.80 \times 10^{-5} \text{ mol dm}^{-3}$.

(a)

[3 marks]

Calculate the pH of the ammonia solution before any HCl is added.

(b)

[3 marks]

Calculate the pH at the equivalence point of this titration.

13.

[8 marks]

A buffer solution is prepared by dissolving 12.0 g of sodium ethanoate (CH_3COONa , $M_r = 82.0$) in 250 cm^3 of $0.500 \text{ mol dm}^{-3}$ ethanoic acid (CH_3COOH). The K_a for ethanoic acid is $1.75 \times 10^{-5} \text{ mol dm}^{-3}$.

(a)

[4 marks]

Calculate the pH of this buffer solution.

(b)

[4 marks]

A small amount of $0.050 \text{ mol dm}^{-3}$ HCl is added to 100 cm^3 of the buffer solution prepared in part (a). Calculate the new pH of the buffer solution after 5.0 cm^3 of HCl has been added. Assume the volume change is negligible for the buffer components.

Total marks: _____ / 45