

AQA A-Level Chemistry

Acids and bases

Questions only

The newest questions, about an hour. All 28 are in the exam generator.

Questions

13

Total marks

46

Time allowed

1 h

Name

Class or teacher

Date

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the AQA Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2022 A-level P3 Q13	1	
2	2023 A-level P3 Q18	1	
3	2023 A-level P3 Q17	1	
4	2024 A-level P3 Q4	11	
5	2024 A-level P3 Q18	1	
6	2024 A-level P1 Q7	8	
7	2023 A-level P3 Q16	1	

Q	Source	Marks	Score
8	2020 A-level P3 Q14	1	
9	2020 A-level P3 Q13	1	
10	2023 A-level P3 Q20	1	
11	2022 A-level P3 Q15	1	
12	2022 A-level P3 Q14	1	
13	2025 A-level P1 Q8	17	

Total _____ / 46 Percentage _____ %

Questions from AQA past papers, 2020–2025, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions?topics=acids-bases&len=0

Questions

Acids and bases · 13 questions · 46 marks · time allowed 1 h

Q1 · June 2022 · Paper 3 · Q13 · [1 mark]

Which can not function as a Brønsted-Lowry acid?

Tick (✓) one box.

☐ A CH_3COO^-

☐ B HCO_3^-

☐ C H_3O^+

☐ D NH_4^+

Q2 · June 2023 · Paper 3 · Q18 · [1 mark]

A $0.100 \text{ mol dm}^{-3}$ solution of a weak acid has $\text{pH} = 2.50$. What is the value of K_a for this acid, in mol dm^{-3} ?

Tick (✓) one box.

☐ A 3.16×10^{-2}

☐ B 3.16×10^{-3}

☐ C 1.00×10^{-4}

☐ D 1.00×10^{-5}

Q3 · June 2023 · Paper 3 · Q17 · [1 mark]

Which change causes the pH of 10 cm^3 of 1.0 mol dm^{-3} NaOH to be halved at 298 K? $K_w = 1.0 \times 10^{-14}$ at 298 K

Tick (✓) one box.

☐ A adding 10 cm^3 of water

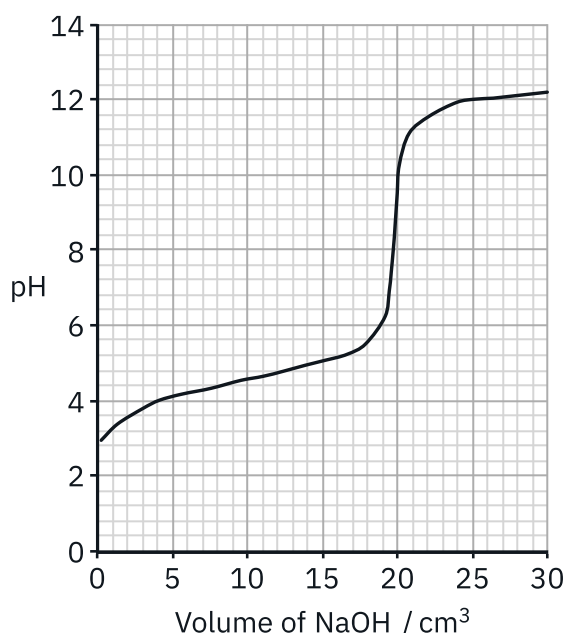
☐ B adding 10 dm^3 of water

☐ C adding 5 cm^3 of 1.0 mol dm^{-3} HCl

☐ D adding 10 cm^3 of 1.0 mol dm^{-3} HCl

Q4 · June 2024 · Paper 3 · Q4 · [11 marks]

The figure below shows how the pH changes as $0.100 \text{ mol dm}^{-3}$ sodium hydroxide solution is added to 25.0 cm^3 of $0.0800 \text{ mol dm}^{-3}$ aqueous propanoic acid at 298 K



(a) Propanoic acid is a weak acid.

State the meaning of weak in this context.

[1 mark]

(b) Suggest why a student doing an experiment to produce the curve in the figure above would add the sodium hydroxide solution dropwise around the equivalence point.

[1 mark]

(c) Give an expression for K_a for propanoic acid ($\text{CH}_3\text{CH}_2\text{COOH}$).

Use this expression to show that $\text{pH} = \text{p}K_a$ when half of the propanoic acid has reacted with sodium hydroxide.

K_a

[3 marks]

(d) Use the pH from the figure above, when half of the propanoic acid has reacted, to calculate K_a at 298 K

$K_a \text{ mol dm}^{-3}$

[2 marks]

(e) When sodium hydroxide solution is added to aqueous propanoic acid, the solution formed acts as a buffer when between 5 cm^3 and 15 cm^3 have been added.

Explain why the pH stays approximately constant during this part of the experiment.

[2 marks]

(f) Methyl orange and universal indicator are not suitable indicators for the titration of solutions of propanoic acid with sodium hydroxide.

State the reason why each indicator is not suitable.

[2 marks]

Methyl orange

Universal indicator

Q5 · June 2024 · Paper 3 · Q18 · [1 mark]

Values of the ionic product of water (K_w) at different temperatures are given. $K_w = 6.40 \times 10^{-15} \text{ mol}^2 \text{ dm}^{-6}$ at 18 °C $K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ at 25 °C Which statement is correct?

Tick (✓) one box.

- ☐ **A** The concentration of hydroxide ions in water at 18 °C is $8.00 \times 10^{-8} \text{ mol dm}^{-3}$
- ☐ **B** The dissociation of water into ions is an exothermic process.
- ☐ **C** The pH of water is the same at 25 °C and at 18 °C
- ☐ **D** Water becomes less acidic as the temperature is raised.

Q6 · June 2024 · Paper 1 · Q7 · [8 marks]

At 40 °C the ionic product of water, $K_w = 2.92 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$

(a) Give the expression for K_w

Calculate the pH of pure water at 40 °C

Give your answer to 2 decimal places.

[3 marks]

K_w

pH

(b) 35.0 cm³ of 0.150 mol dm⁻³ aqueous sodium hydroxide are mixed with 20.0 cm³ of a 0.100 mol dm⁻³ solution of hydrochloric acid.

The temperature of the solution formed is 40 °C

Calculate the pH of the solution formed.

Give your answer to 2 decimal places.

pH

[5 marks]

Q7 · June 2023 · Paper 3 · Q16 · [1 mark]

Which species can behave as a Brønsted–Lowry acid in aqueous solution?

Tick (✓) one box.

☐ A SO₄²⁻

☐ B HCO₃⁻

☐ C BF₃

☐ D NH₃

Q8 • November 2020 • Paper 3 • Q14 • [1 mark]

A 0.10 mol dm^{-3} aqueous solution of an acid is added slowly to 25 cm^3 of a 0.10 mol dm^{-3} aqueous solution of a base. Which acid–base pair has the highest pH at the equivalence point?

Tick (✓) one box.

- ☐ **A** CH_3COOH and NaOH
- ☐ **B** CH_3COOH and NH_3
- ☐ **C** HCl and NaOH
- ☐ **D** HCl and NH_3

Q9 • November 2020 • Paper 3 • Q13 • [1 mark]

Which statement about pH is correct?

Tick (✓) one box.

- ☐ **A** The pH of a weak base is independent of temperature.
- ☐ **B** At temperatures above 298 K , the pH of pure water is less than 7.
- ☐ **C** The pH of 2.0 mol dm^{-3} nitric acid is approximately 0.30
- ☐ **D** The pH of 0.10 mol dm^{-3} sulfuric acid is greater than that of 0.10 mol dm^{-3} hydrochloric acid.

Q10 • June 2023 • Paper 3 • Q20 • [1 mark]

Equal volumes of pairs of solutions are mixed. Which pair forms a buffer solution?

Tick (✓) one box.

- ☐ **A** ammonia and ammonium chloride
- ☐ **B** ammonia and methylamine
- ☐ **C** ethanoic acid and methanoic acid
- ☐ **D** hydrochloric acid and sodium hydroxide

Q11 · June 2022 · Paper 3 · Q15 · [1 mark]

Equal volumes of two solutions, each with the same concentration, are mixed together at 298 K. Which two solutions, when mixed, form a solution with a pH > 7?

Tick (✓) one box.

- ☐ **A** HCOOH and HCOOK
- ☐ **B** KOH and CH₃COOH
- ☐ **C** NH₃ and HCl
- ☐ **D** NH₄Cl and KCl

Q12 · June 2022 · Paper 3 · Q14 · [1 mark]

A strong acid H₂X dissociates in aqueous solution. $\text{H}_2\text{X}(\text{aq}) \rightarrow 2 \text{H}^+(\text{aq}) + \text{X}^{2-}(\text{aq})$ What is the pH of a 0.020 mol dm⁻³ solution of this acid?

Tick (✓) one box.

- ☐ **A** 1.00
- ☐ **B** 1.40
- ☐ **C** 1.70
- ☐ **D** 2.00

Q13 · June 2025 · Paper 1 · Q8 · [17 marks]

This question is about acids and bases.

08.1 Nitric acid is a strong acid.

Calculate the pH of 0.150 mol dm⁻³ nitric acid.

Give your answer to 2 decimal places.

pH

[2 marks]

08.2 Propanoic acid is a weak acid.

Calculate the concentration of a solution of propanoic acid with $\text{pH} = 2.89$ at $25\text{ }^{\circ}\text{C}$

The acid dissociation constant (K_{a}) for propanoic acid at $25\text{ }^{\circ}\text{C}$

[4 marks]

is $1.35 \times 10^{-5} \text{ mol dm}^{-3}$

Concentration mol dm^{-3}

A student records the pH as an alkali is added to an acid.

Figure 3 shows the pH curve for this reaction.

Figure 3

08.3 Which of these combinations gives the pH curve shown in Figure 3?

Tick () one box.

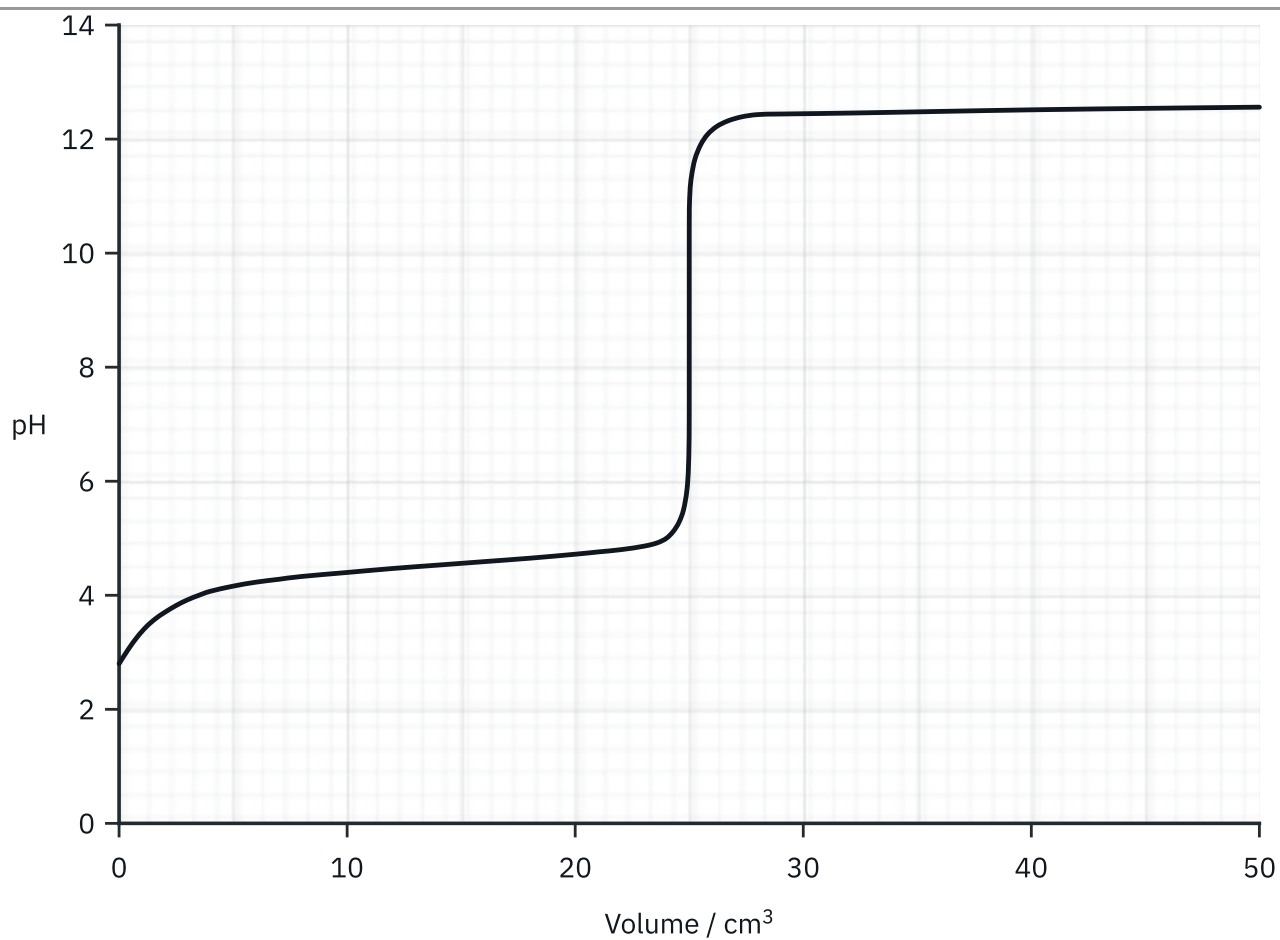
[1 mark]

Strong alkali added to strong acid

Strong alkali added to weak acid

Weak alkali added to strong acid

Weak alkali added to weak acid



08.4 Different indicators change colour across different pH ranges.

Tick () the box of each indicator that would change colour at the equivalence point in Figure 3.

Name of indicator	pH range
Methyl orange	3.2–4.4
Bromocresol green	3.8–5.4
Cresol red	7.2–8.8
Naphtholphthalein	7.3–8.7
Cresolphthalein	8.2–9.8
Indigo carmine	11.5–14.0

Buffer solution B is made by dissolving 0.656 g of sodium ethanoate ($M_r = 82.0$) in 50 cm³ of 0.120 mol dm⁻³ ethanoic acid.

This buffer solution has pH = 4.87

[1 mark]

08.5 Explain, qualitatively, how this buffer solution resists pH change when a small amount of sodium hydroxide solution is added.

[2 marks]

08.6 Calculate the pH change that occurs when 1.50 cm³ of 0.200 mol dm⁻³ HCl(aq) are added to buffer solution B.

Give your answer to 2 decimal places.

The acid dissociation constant (K_a) for ethanoic acid at 25 °C is $1.78 \times 10^{-5} \text{ mol dm}^{-3}$

pH change

[7 marks]

[illegible]

Source: AQA A-Level Chemistry past papers. Reproduced for revision at whiteboardchemistry.com.

Mark scheme:

whiteboardchemistry.com/revision/aqa-a-level-chemistry/exam-questions/pdf/acids-bases-mark-scheme.pdf