

OCR A-Level Chemistry A

Acids and redox reactions

Questions only

The newest questions, about an hour. All 16 are in the exam generator.

Questions

9

Total marks

41

Time allowed

55 min

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 OCR Data Sheet.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2019 P1 Q5	1	
2	2022 P1 Q6	1	
3	2023 P3 Q5	11	
4	2025 P1 Q4	1	
5	2025 P1 Q8	1	
6	2020 P1 Q1	1	
7	2021 P1 Q18	12	
8	2021 P1 Q3	1	
9	2021 P3 Q3	12	

Total _____ / 41 Percentage _____ %

Questions from OCR past papers, 2019–2025, reproduced for revision. Practise these topics online, with instant marking:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/?topics=acids-and-redox&len=0

Questions

Acids and redox reactions · 9 questions · 41 marks · time allowed 55 min

Q1 · June 2019 · Paper 1 (Periodic table, elements and physical chemistry) · Q5 · [1 mark]

What is the oxidation number of N in $\text{Mg}(\text{NO}_2)_2 \cdot 3\text{H}_2\text{O}$?

Tick (✓) one box.

- ☐ **A** +2
- ☐ **B** +3
- ☐ **C** +4
- ☐ **D** +5
-

Q2 · June 2022 · Paper 1 (Periodic table, elements and physical chemistry) · Q6 · [1 mark]

Prussian blue, $\text{C}_{18}\text{Fe}_7\text{N}_{18}$, is a deep blue pigment containing Fe^{2+} , Fe^{3+} and CN^- ions.

What are the numbers of Fe^{2+} and Fe^{3+} ions in one formula unit of $\text{C}_{18}\text{Fe}_7\text{N}_{18}$?

Tick (✓) one box.

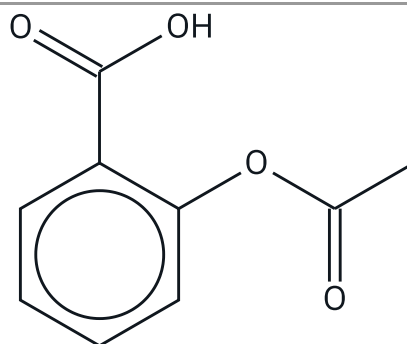
- ☐ **A** 2 Fe^{2+} and 5 Fe^{3+}
- ☐ **B** 3 Fe^{2+} and 4 Fe^{3+}
- ☐ **C** 4 Fe^{2+} and 3 Fe^{3+}
- ☐ **D** 5 Fe^{2+} and 2 Fe^{3+}
-

Q3 · June 2023 · Paper 3 (Unified chemistry) · Q5 · [11 marks]

This question also needs Organic synthesis, IR and mass spectra.

Aspirin tablets are used for pain relief.

The structure of aspirin is shown below.

**Aspirin**

5(a) A student uses the reaction of aspirin with cold NaOH(aq) to determine the mass of aspirin in **one** tablet.

In this reaction, 1 mol of aspirin reacts with 1 mol of cold NaOH(aq).

The student's method is outlined below.

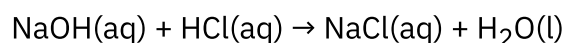
Step 1 The student reacts **three** aspirin tablets with 100 cm³ of 0.500 mol dm⁻³ NaOH(aq).

The NaOH is in excess. A colourless solution forms.

Step 2 The colourless solution from Step 1 is made up to 250.0 cm³ with distilled water.

Step 3 A 25.00 cm³ sample of the diluted solution from Step 2 is titrated with 0.200 mol dm⁻³ HCl(aq) in the burette.

The HCl(aq) reacts with excess NaOH(aq) that remains in Step 1:



The student repeats the titration to obtain concordant (consistent) titres.

Titration results

The trial titre has been omitted.

The burette readings have been read to the nearest 0.05 cm³.

	1	2	3
Final reading / cm ³	23.10	45.40	27.40
Initial reading / cm ³	0.00	23.10	5.00

Analysis of results

From the results, the student can determine the following.

1. The amount, in mol, of excess NaOH(aq) that remains after the reaction of aspirin with NaOH(aq).
2. The amount, in mol, of NaOH(aq) that reacted with the aspirin.

Use the results to determine the mass, in mg, of aspirin in **one** aspirin tablet.

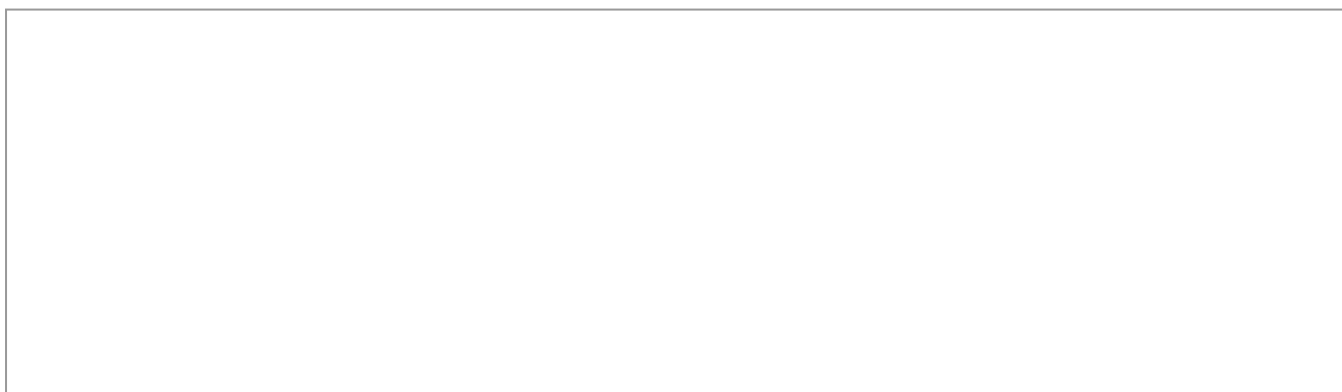
mass of aspirin in **one** tablet = mg

[6 marks]

Aspirin reacts with hot NaOH(aq), under reflux.

5(b)(i) Draw a labelled diagram of suitable apparatus for reflux.

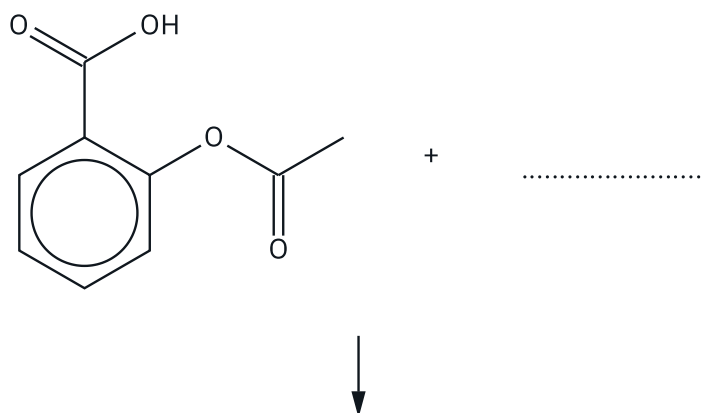
[2 marks]



5(b)(ii) In this reaction, 1 mol of aspirin reacts with 3 mol of hot NaOH(aq).

Complete the equation for the reaction of aspirin with an excess of hot NaOH(aq).

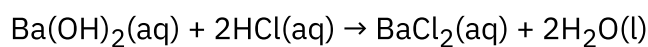
Show structures for organic compounds.



[3 marks]

Q4 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q4 · [1 mark]

What volume, in cm^3 , of $0.250 \text{ mol dm}^{-3}$ barium hydroxide solution is required to exactly neutralise 25.0 cm^3 of $0.115 \text{ mol dm}^{-3}$ hydrochloric acid?



Tick (✓) one box.

- ☐ **A** 5.75
- ☐ **B** 11.50
- ☐ **C** 23.00
- ☐ **D** 54.35

Q5 · June 2025 · Paper 1 (Periodic table, elements and physical chemistry) · Q8 · [1 mark]

The burette readings from an experiment are shown:

Final reading / cm^3	29.35
Initial reading / cm^3	2.60

The burette has an uncertainty of $\pm 0.05 \text{ cm}^3$.

What is the percentage uncertainty of the titre?

Tick (✓) one box.

- ☐ **A** 0.17%
- ☐ **B** 0.19%
- ☐ **C** 0.34%
- ☐ **D** 0.37%

Q6 · November 2020 · Paper 1 (Periodic table, elements and physical chemistry) · Q1 · [1 mark]

Several students titrate 25.00 cm^3 of the same solution of sodium hydroxide, NaOH(aq) with hydrochloric acid, HCl(aq) .

One student obtains a smaller titre than the other students.

Which procedure explains the smaller titre?

Tick (✓) one box.

- ☐ **A** The burette readings are taken from the top of the meniscus instead of the bottom of the meniscus.
- ☐ **B** The conical flask is rinsed with water before carrying out the titration.
- ☐ **C** An air bubble is released from the jet of the burette during the titration.
- ☐ **D** The pipette is rinsed with water before filling with NaOH(aq) .

Q7 · November 2021 · Paper 1 (Periodic table, elements and physical chemistry) · Q18 · [12 marks]

This question also needs Acids, bases and buffers, Amount of substance and Redox and electrode potentials.

A student carries out an experiment to determine the percentage by mass of copper in an ore containing copper in its +2 oxidation state.

The student is provided with a sample of the copper ore, 1 mol dm^{-3} potassium iodide, KI(aq) , and $0.0200 \text{ mol dm}^{-3}$ sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$.

The student's method is outlined below.

Step 1 Add an excess of warm nitric acid to 2.50 g of the ore.

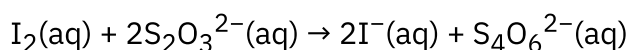
The copper(II) compounds in the ore react, forming aqueous copper(II) nitrate.

Step 2 Filter the mixture to remove the unreacted rock. Neutralise the filtrate.

Step 3 Add an excess of aqueous potassium iodide, KI(aq) .

A precipitate of copper(I) iodide and a solution of iodine, $\text{I}_2(\text{aq})$, forms.

Step 4 Titrate the mixture from Step 3 using $0.0200 \text{ mol dm}^{-3}$ sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$ in the burette.



26.55 cm³ of 0.0200 mol dm⁻³ Na₂S₂O₃ are required to reach the end point.

18(a) In Step 1, the student observed that bubbles of gas were produced.

Suggest the formula of the copper(II) compound which reacted with HNO₃ to form the gas, and write a full equation for the reaction.

Formula:

Equation:

[2 marks]

18(b) Write an ionic equation, including state symbols, for the reaction in Step 3.

[1 mark]

18(c) Suggest a suitable indicator for this titration and state the colour change at the end point in Step 4.

Indicator:

Colour from to

[1 mark]

18(d) Determine the percentage, by mass, of copper in the copper ore.

Give your answer to an appropriate number of significant figures.

percentage = %

[4 marks]

Explain whether the calculated percentage by mass of copper would be higher, lower or the same if the following changes were made to the method.

18(e)(i) The potassium iodide was not in excess, in Step 3.

[1 mark]

18(e)(ii) The burette readings were read from the top of the meniscus, in Step 4.

[1 mark]

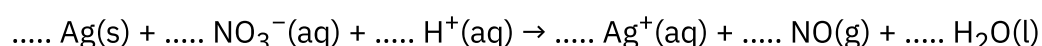
18(f) The student then modifies the method in order to obtain a more accurate value for the percentage by mass of copper in the ore. The student decides to use 25.00 g of the copper ore in Step 1.

What further modifications should the student make to produce a more accurate value for the percentage by mass of copper in the ore?

[2 marks]

Q8 • November 2021 • Paper 1 (Periodic table, elements and physical chemistry) • Q3 • [1 mark]

The unbalanced equation for the reaction of silver with concentrated nitric acid is shown below.



Which numbers for Ag and H₂O will balance the equation?

Tick (✓) one box.

☐ **A** Ag(s): 1 · H₂O(l): 2

☐ **B** Ag(s): 2 · H₂O(l): 3

☐ **C** Ag(s): 3 · H₂O(l): 1

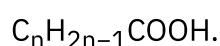
☐ **D** Ag(s): 3 · H₂O(l): 2

Q9 • November 2021 • Paper 3 (Unified chemistry) • Q3 • [12 marks]

This question also needs Acids, bases and buffers, Alkenes and addition polymers, Amount of substance and 2 other topics.

This question is about carboxylic acids.

Compound D is a cis stereoisomer of an unsaturated organic acid with the general formula



A student plans to analyse acid D by carrying out a titration.

3(a) A student first prepares 250.0 cm^3 of a standard solution of $0.150 \text{ mol dm}^{-3} \text{ Ba(OH)}_2$ for the titration.

The student is provided with solid Ba(OH)_2 and usual laboratory apparatus and equipment.

Describe how the student would prepare the standard solution, giving full details of quantities, apparatus and method.

[5 marks]

3(b) The student prepares a 100.0 cm^3 solution containing 3.215 g of acid D.

The student titrates 25.0 cm^3 samples of the solution of D with $0.150 \text{ mol dm}^{-3} \text{ Ba(OH)}_2(\text{aq})$ in the burette.

1 mol Ba(OH)_2 reacts with 2 mol of D.

The mean titre of $\text{Ba(OH)}_2(\text{aq})$ is 23.50 cm^3 .

Analyse the titration results to determine two possible structures for the cis stereoisomer of organic acid D.

Structures of 2 possible cis stereoisomers of acid D

[7 marks]

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

Mark scheme:

whiteboardchemistry.com/revision/exam-questions/ocr-a-level-chemistry/pdf/acids-and-redox-mark-scheme.pdf