

AQA A-Level Chemistry

Reactions of aqueous ions

Questions only

The newest questions, about an hour. All 6 are in the exam generator.

Questions

5

Total marks

43

Time allowed

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

For marking

Q	Source	Marks	Score
1	2020 A-level P1 Q5	10	
2	2024 A-level P3 Q22	1	
3	2023 A-level P1 Q7	17	
4	2023 A-level P3 Q4	6	
5	2018 A-level P1 Q7	9	

Total _____ / 43 Percentage _____ %

Questions from AQA past papers, 2018–2024, reproduced for revision. Practise these topics online, with instant marking:

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

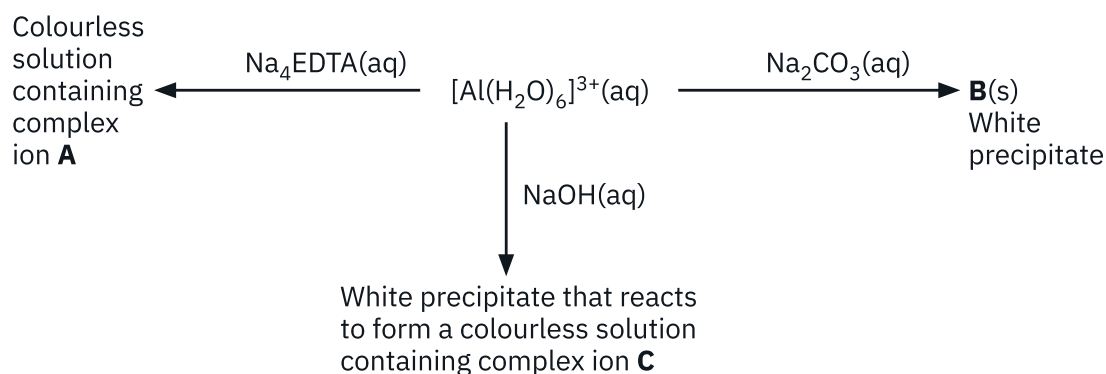
Questions

Reactions of aqueous ions · 5 questions · 43 marks · time allowed 56 min

Q1 · November 2020 · Paper 1 · Q5 · [10 marks]

This question also needs Transition metals.

Some reactions of the $[\text{Al}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ ion are shown.



(a) Give the formula of the white precipitate B.

State one other observation when $\text{Na}_2\text{CO}_3(\text{aq})$ is added to a solution containing $[\text{Al}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ ions.

Give an equation for this reaction.

[3 marks]

Formula of B

Observation

Equation

(b) Give the formula of the complex ion C.

State one condition needed for the formation of C from $[\text{Al}(\text{H}_2\text{O})_6]^{3+}(\text{aq})$ and $\text{NaOH}(\text{aq})$.

Give an equation for this reaction.

[3 marks]

Formula of C

Condition

Equation

(c) Deduce the formula of the complex ion A.

[1 mark]

(d) Explain, with the use of an equation, why a solution containing $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ has a $\text{pH} < 7$

[3 marks]

Equation

Explanation

Q2 • June 2024 • Paper 3 • Q22 • [1 mark]

Aqueous aluminium sulfate is added to aqueous sodium carbonate. What are the formulas of the precipitate and the gas formed?

Tick (✓) one box.

- ☐ **A** $\text{Al}_2(\text{CO}_3)_3$ and SO_2
- ☐ **B** $\text{Al}_2(\text{CO}_3)_3$ and CO_2
- ☐ **C** $\text{Al}(\text{H}_2\text{O})_3(\text{OH})_3$ and SO_2
- ☐ **D** $\text{Al}(\text{H}_2\text{O})_3(\text{OH})_3$ and CO_2

Q3 • June 2023 • Paper 1 • Q7 • [17 marks]

This question also needs Amount of substance and Transition metals.

This question is about complexes containing the aluminium ion.

(a) Give the electron configuration of the Al^{3+} ion.

[1 mark]

(b) When anhydrous aluminium sulfate, $\text{Al}_2(\text{SO}_4)_3$, is added to water a solution forms that contains the complex aluminium ion, $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$

Give the equation for the reaction.

[1 mark]

(c) Explain why the solution containing $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ is acidic.

[2 marks]

(d) State why the concentration of aluminium sulfate solution can not be determined by colorimetry.

[1 mark]

(e) An excess of aqueous ammonia is added to a solution containing $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$

Give an ionic equation for the reaction and state one observation.

[2 marks]

Equation

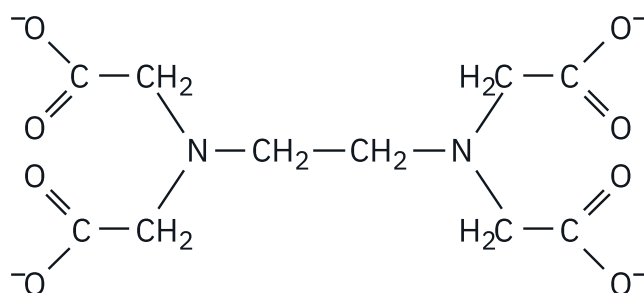
Observation

(f) An excess of dilute sulfuric acid is added to the products of the reaction in part (e).

Identify the aluminium species produced.

[1 mark]

(g) The figure below shows the structure of the EDTA^{4-} ion.



Atoms of two different elements in EDTA^{4-} can form co-ordinate bonds with an aluminium ion.

On the figure above, draw circles around the atoms of two different elements that would link to an aluminium ion by a co-ordinate bond.

[2 marks]

Draw your answer on the figure above.

(h) Hydrated aluminium sulfate, $\text{Al}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$, is soluble in water.

The relative formula mass and value of x can be found from a titration experiment.

Aqueous $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$ ions react to form a stable complex when treated with an excess of EDTA^{4-} ions.

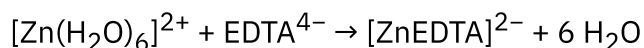
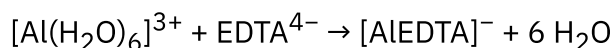
The excess of EDTA^{4-} ions is determined by titration with ZnSO_4 solution.

Method

- Dissolve 1.036 g of $\text{Al}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$ in distilled water and make up to 250 cm^3
- Add 25.0 cm^3 of this solution to 50.0 cm^3 of a solution containing EDTA^{4-} ions of concentration $0.0100 \text{ mol dm}^{-3}$
- Determine the excess of EDTA^{4-} ions by titrating with ZnSO_4 solution in the presence of an indicator.

The excess of EDTA^{4-} ions requires 18.00 cm^3 of $0.0105 \text{ mol dm}^{-3}$ ZnSO_4 solution to react completely.

The equations for the reactions are



For $\text{Al}_2(\text{SO}_4)_3$ $M_r = 342.3$

Use the information given to calculate the M_r of $\text{Al}_2(\text{SO}_4)_3 \cdot x\text{H}_2\text{O}$

Calculate x

Give your answer as an integer.

[7 marks]

M_r

X

Q4 • June 2023 • Paper 3 • Q4 • [6 marks]

This question also needs Group 2 and Group 7.

A student is given two aqueous solutions, L and M, that both contain iron salts.

The student does a series of tests on the solutions.

The table below shows these tests and the observations.

Test	Observations with L	Observations with M
Add ammonia solution slowly until in excess.	A red-brown precipitate forms that is insoluble in excess.	A green precipitate forms that is insoluble in excess.
Add sodium carbonate solution.	A red-brown precipitate forms. Effervescence is seen.	A green precipitate forms.
Add dilute nitric acid and then divide into two portions.	No change is seen.	No change is seen.
Add barium chloride solution to the first portion.	No change is seen.	A white precipitate forms.
Add silver nitrate solution to the second portion.	A white precipitate forms.	No change is seen.

Identify L and M using the results in the table.

In your answer:

- identify all precipitates
- explain why effervescence is seen in the reaction of sodium carbonate with L but not with M

- give ionic equations for all reactions.

Q5 • June 2018 • Paper 1 • Q7 • [9 marks]

07.1 When anhydrous aluminium chloride reacts with water, solution Y is formed that contains a complex aluminium ion, Z, and chloride ions.

Give an equation for this reaction.

[1 mark]

07.2 Give an equation to show how the complex ion Z can act as a Brønsted–Lowry acid with water.

[1 mark]

07.3 Describe two observations you would make when an excess of sodium carbonate solution is added to solution Y.

Give an equation for the reaction. In your equation, include the formula of each complex aluminium species.

[3 marks]

Observation 1

Observation 2

Equation

07.4 Aqueous potassium hydroxide is added, until in excess, to solution Y.

Describe two observations you would make.

For each observation give an equation for the reaction that occurs.

In your equations, include the formula of each complex aluminium species.

[4 marks]

Observation 1

Equation 1

Observation 2

Equation 2

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/aqueous-ions-mark-scheme.pdf