InkChemistry

QUESTION WORKBOOK

Reactions of aqua ions with hydroxide, ammonia and carbonate

Ions in aqueous solution · Unit C15

AQA 3.2.6 · OCR A 5.3.1 (j), 5.3.2

20 questions · 65 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 RAI-Q3

Complete the equation, with state symbols, for the reaction of $[Fe(H_2O)_6]^{2+}$ with aqueous ammonia: $[Fe(H_2O)_6]^{2+}(aq) + 2NH_3(aq) \rightarrow$ [2]

A2 RAI-Q14

Suggest why a student who pours sodium hydroxide quickly into a solution of aluminium sulfate may record that no precipitate forms. [2]

A3 RAI-Q21

Give the equation, with state symbols, for the reaction of $[Mn(H_2O)_6]^{2+}$ with a little aqueous ammonia, and give the observation. [2]

SECTION B · Standard, 3 to 5 marks

B1 RAI-Q1

Describe what is seen when a few drops of sodium hydroxide solution are added to iron(II) sulfate solution and the tube is then left open to the air, and explain the change on standing. [4]

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B2 RAI-Q2

Give the equation, with state symbols, for the reaction of $[Cu(H_2O)_6]^{2+}$ with a little aqueous ammonia and the observation, and name the type of reaction that occurs with a little ammonia and with excess ammonia. [4]

B3 RAI-Q7

Explain why the blue precipitate formed from $[Cu(H_2O)_6]^{2+}$ and a little ammonia dissolves when excess ammonia is added. Include an equation. [4]

B4 RAI-Q15

Compare the reactions of aluminium hydroxide with excess sodium hydroxide and with excess aqueous ammonia, and explain the difference. [4]

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B5 RAI-Q16 Evaluate a student's plan to identify which of four solutions contains Fe^{2+}, Cu^{2+}, Fe^{3+} or Al^{3+} by adding a few drops of aqueous ammonia to each and noting only the colour of the precipitate. [4]

B6 RAI-Q4 Describe what is seen when sodium hydroxide solution is added drop by drop, and then in excess, to a solution of aluminium sulfate. [3]

B7 RAI-Q5 Explain what is meant by amphoteric, using two equations for aluminium hydroxide to illustrate your answer. [3]

B8 RAI-Q6 Explain why aqueous ammonia and sodium hydroxide solution give the same precipitate with a solution of $[Fe(H_2O)_6]^{3+}$. [3]

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B9 RAI-Q9

Identify the metal-aqua ion in a solution that gives a brown precipitate with sodium hydroxide, a brown precipitate that does not dissolve in excess ammonia, and effervescence with sodium carbonate. Give a reason from the observations for each part of your answer. [3]

B10 RAI-Q10

Calculate the volume of 0.400 mol dm^{-3} sodium hydroxide solution needed to precipitate all of the iron in 25.0 cm^3 of a 0.100 mol dm^{-3} solution of $[Fe(H_2O)_6]^{3+}$. [3]

B11 RAI-Q11

Calculate the volume of carbon dioxide, at room temperature and pressure, released when excess sodium carbonate is added to 50.0 cm^3 of a 0.200 mol dm^{-3} solution of $[Al(H_2O)_6]^{3+}$. [3]

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B12 RAI-Q12 Calculate the mass of aluminium hydroxide, written as $Al(OH)_3$, precipitated when ammonia is added to 20.0 cm^3 of a 0.150 mol dm^{-3} solution of $[Al(H_2O)_6]^{3+}$. Ar: Al 27.0, O 16.0, H 1.0. [3]

B13 RAI-Q13 Suggest what is seen when sodium hydroxide solution is added drop by drop, and then in excess, to zinc sulfate solution, given that zinc hydroxide is amphoteric and $[Zn(H_2O)_6]^{2+}$ is colourless. Write an equation for the reaction in excess. [3]

B14 RAI-Q19 Explain, with an equation, why the grey-green precipitate formed from $[Cr(H_2O)_6]^{3+}$ and a few drops of sodium hydroxide dissolves when excess sodium hydroxide is added. [3]

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B15 RAI-Q20 Suggest the identity of the aqua ion in a pink solution that gives a blue precipitate with a little aqueous ammonia, the precipitate dissolving in excess ammonia to a pale straw-coloured solution that darkens on standing in air. Write an equation, with state symbols, for the reaction in excess ammonia. [3]

B16 RAI-Q22 Justify the instruction to add sodium hydroxide solution until it is in excess, not just a few drops, when deciding whether a colourless solution contains Al^{3+} ions or Mg^{2+} ions. [3]

SECTION C · Long, 6 marks or more

C1 RAI-Q17 Outline a method, using test-tube reactions, to show that a solution contains $Cu^{2+}(aq)$ and not $Fe^{2+}(aq)$, $Fe^{3+}(aq)$ or $Al^{3+}(aq)$. Give the expected observations and equations. [6]

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