Chem!stry

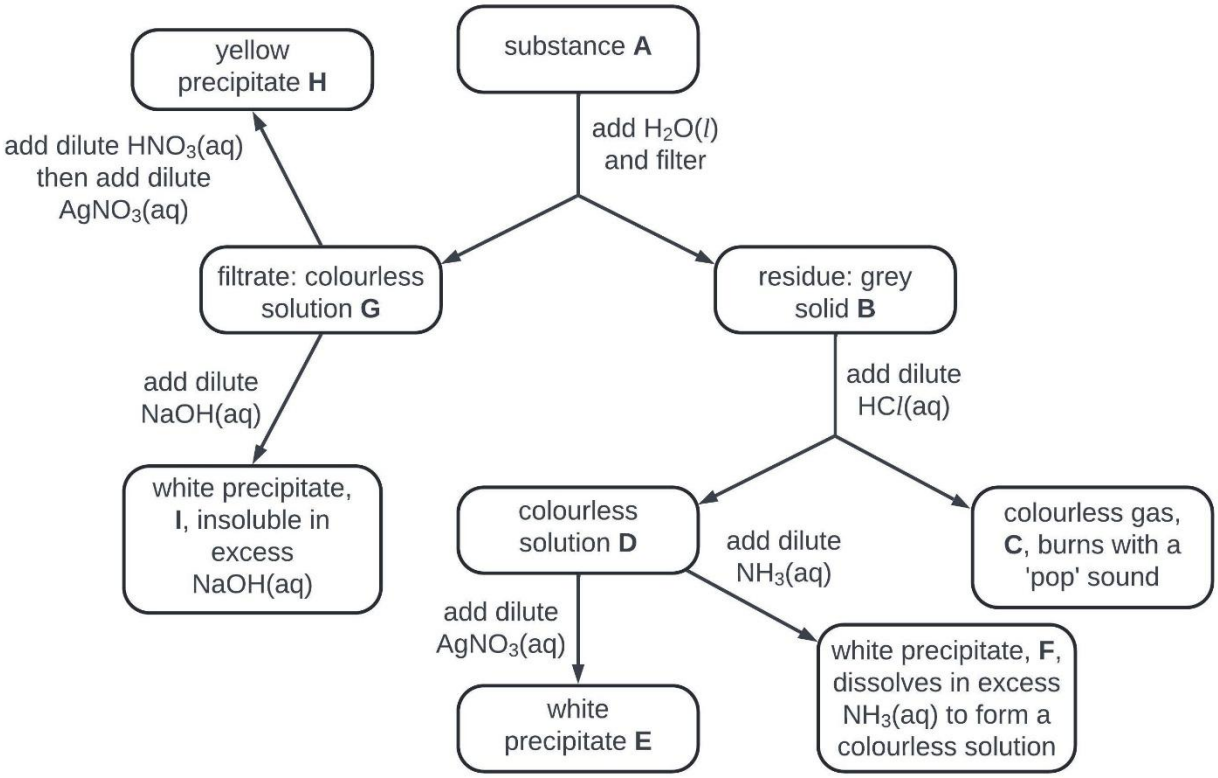
Name: …… **( )**

Class: ……

Date: …… **/** …… **/** ……

Qualitative Analysis

1. Substance **A** is a mixture of element **B** and compound **G**. Compound **G** is soluble in water, but element **B** is insoluble. The reaction scheme below shows the results of some experiments that were performed on substance **A**.



(a) Identify substance **A**. ……

(b) Name element **B**. ……

(c) Name gas **C**. ……

(d) Give the formula of solution **D**. ……

(e) Give the formula of precipitate **E**. ……

(f) Give the formula of precipitate **F**. ……

(g) Name compound **G**. ……

(h) Give the formula of precipitate **H**. ……

(i) Give the formula of precipitate **I**. ……

(j) Why is nitric acid **not** added before aqueous silver nitrate is added to solution **D**?

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(k) Write the balanced chemical equation for the reaction between colourless solution **G** and dilute aqueous sodium hydroxide to form white precipitate **I**.

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(l) Write the ionic equation for the reaction between element **B** and dilute hydrochloric acid to form colourless gas **C** and colourless solution **D**.

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(m) Briefly explain how a pure sample of the metallic element that is present in solution **G** be extracted from the aqueous solution.

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2. A student is given a mixture that contains solid element **B** mixed with crystals of copper(II) sulfate. The student wants to separate the mixture by adding water and filtering, similar to the method used to separate element **B** and compound **G** in **Question 1**. Will the student be successful in separating this mixture? Explain your answer.

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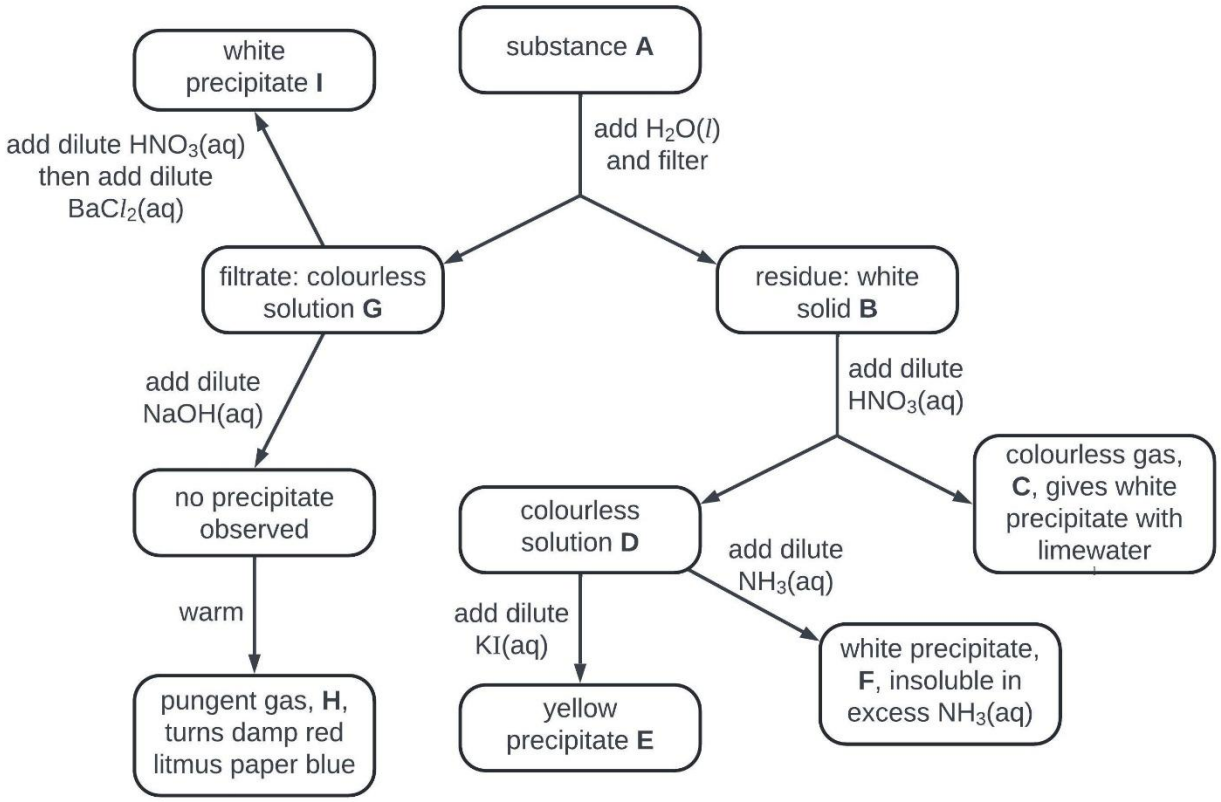
3. Substance **A** is a mixture of two compounds. Compound **G** is soluble in water, but compound **B** is insoluble. The reaction scheme below shows the results of some experiments that were performed on substance **A**.



(a) Identify substance **A**. ……

(b) Name compound **B**. ……

(c) Name gas **C**. ……

(d) Give the formula of solution **D**. ……

(e) Give the formula of precipitate **E**. ……

(f) Give the formula of precipitate **F**. ……

(g) Name compound **G**. ……

(h) Name gas **H**. ……

(i) Give the formula of precipitate **I**. ……

(j) Why is nitric acid **not** added before aqueous potassium iodide is added to solution **D**?

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(k) Write the balanced chemical equation for the reaction between white solid **B** and dilute nitric acid to form colourless gas **C** and colourless solution **D**.

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(l) Write the ionic equation for the reaction between solution **G** and dilute aqueous sodium hydroxide to produce pungent gas **H**.

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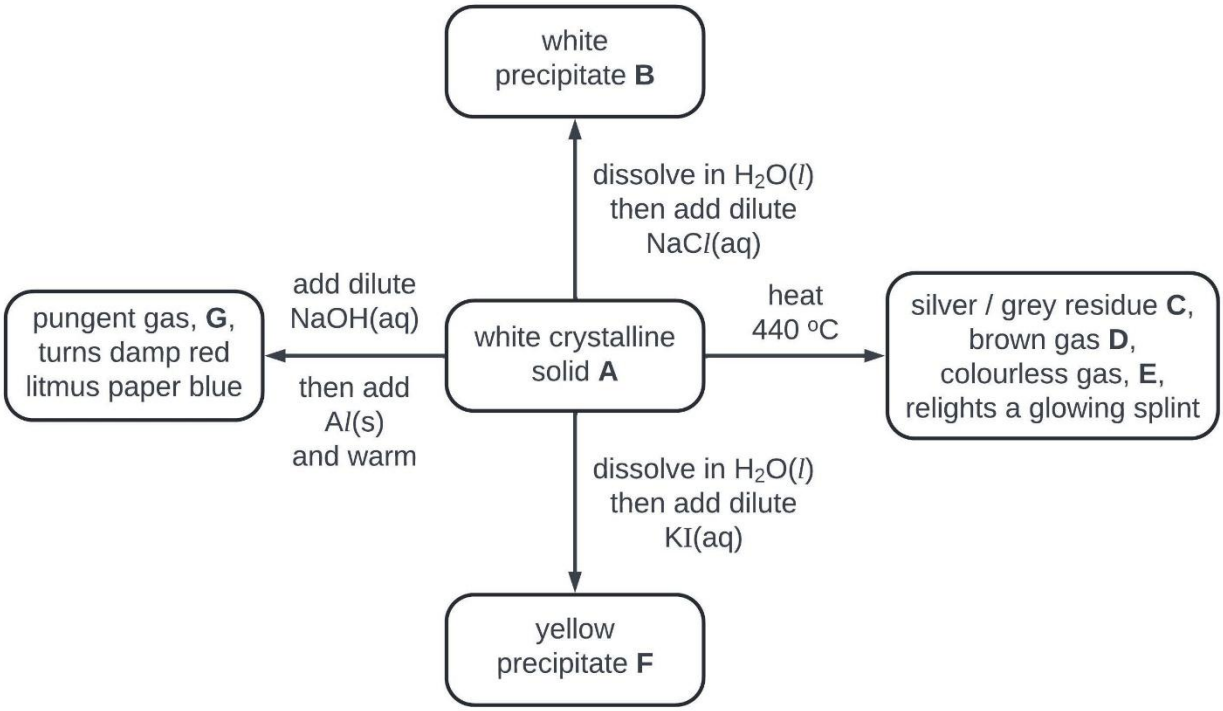
4. Unknown white crystalline solid **A** contains one cation and one anion. The reaction scheme below shows the results of some experiments that were performed on substance **A**.



(a) **(i)** Identify the cation present in substance **A**. ……

(ii) Identify the anion present in substance **A**. ……

(b) Give the formula of precipitate **B**. ……

(c) Name residue **C**. ……

(d) Name gas **D**. ……

(e) Name gas **E**. ……

(f) Give the formula of precipitate **F**. ……

(g) Name gas **G**. ……

(h) Write the balanced chemical equation for the thermal decomposition of white crystalline solid **A** to form grey residue **C**, brown gas **D** and colourless gas **E**.

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(i) Write the ionic equation for the reaction between the aqueous solution of **A** and dilute aqueous sodium chloride to produce white precipitate **B**.

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(j) A piece of copper foil is added to a test tube containing an aqueous solution of **A**.

(i) Write the balanced chemical equation for the reaction that takes place between the copper foil and the aqueous solution of **A**.

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(ii) Describe what would be observed when the copper foil reacts with the solution of **A**.

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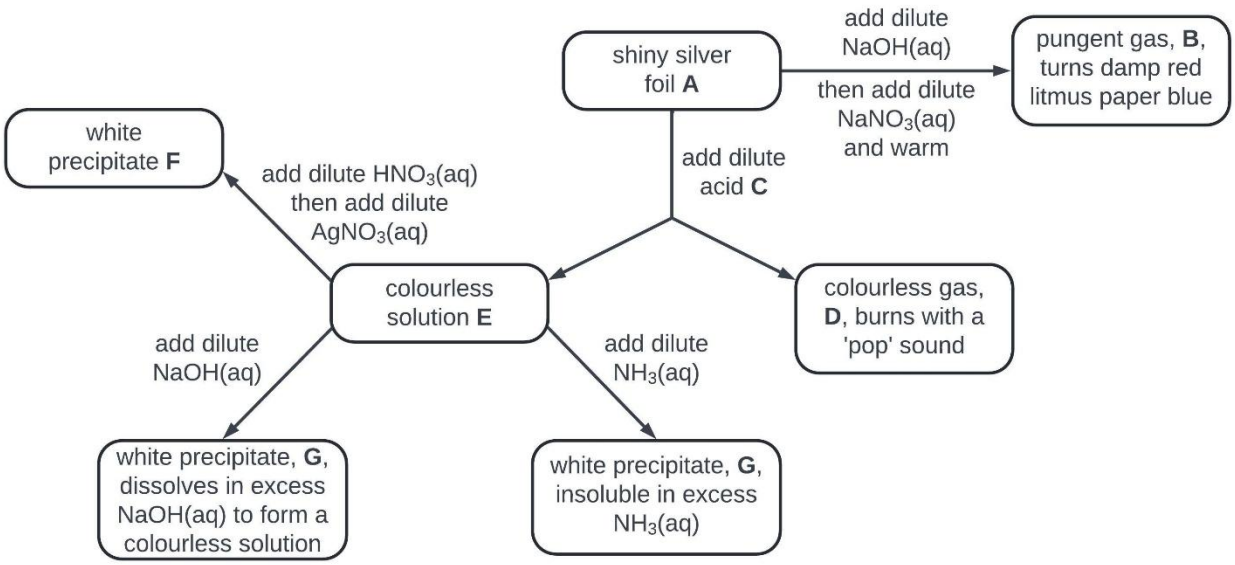
5. Unknown shiny silver foil **A** is a metallic element. The reaction scheme below shows the results of some experiments that were performed on metallic element **A**.



(a) Name solid **A**. ……

(b) Name gas **B**. ……

(c) Give the formula of acid **C**. ……

(d) Name gas **D**. ……

(e) Give the formula of solution **E**. ……

(f) Give the formula of precipitate **F**. ……

(g) Give the formula of precipitate **G**. ……

(h) Write the balanced chemical equation for the reaction between solid **A** and dilute acid **C** to produce gas **D** and solution **E**.

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(i) Write the balanced chemical equation for the reaction between solution **E** and dilute aqueous ammonia to form precipitate **G**.

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(j) The results obtained when dilute aqueous sodium hydroxide and dilute aqueous ammonia are added to solution **E** are inconclusive because two different cations could give the same set of results.

(i) Give the formulae of the two cations that give the same results when dilute aqueous sodium hydroxide and dilute aqueous ammonia are added.

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(ii) What evidence given in the reaction scheme allows you to determine which one of the two cations is actually present in solution **E**?

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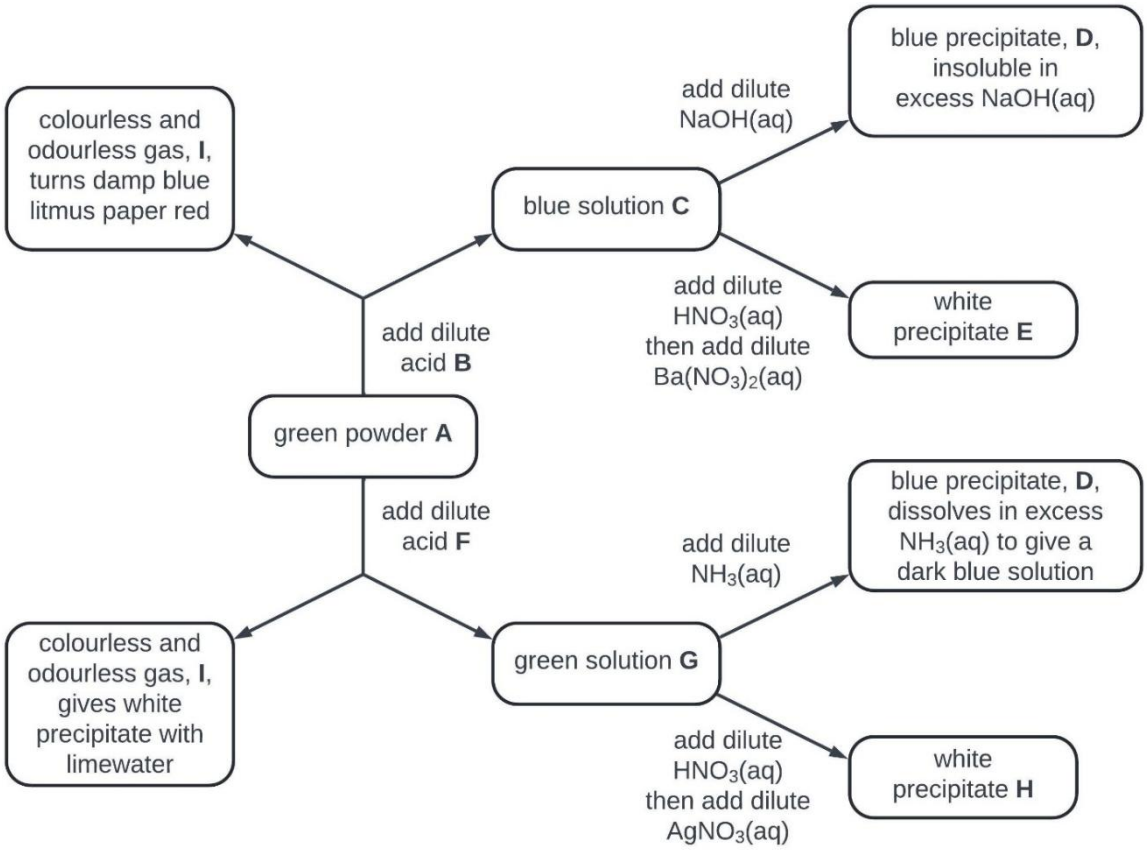
6. Unknown green powder **A** contains one cation and one anion. The reaction scheme below shows the results of some experiments that were performed on green powder **A**.



(a) Name solid **A**. ……

(b) Name acid **B**. ……

(c) Give the formula of solution **C**. ……

(d) Give the formula of precipitate **D**. ……

(e) Give the formula of precipitate **E**. ……

(f) Name acid **F**. ……

(g) Give the formula of solution **G**. ……

(h) Give the formula of precipitate **H**. ……

(i) Name gas **I**. ……

(j) Write the ionic equation for the reaction between blue solution **C** and dilute aqueous barium nitrate to form white precipitate **E**.

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(k) Green powder **A** undergoes thermal decomposition to form a black powder and colourless gas. The black powder is basic in nature, while the colourless gas gives a white precipitate with limewater.

Write a balanced chemical equation for the thermal decomposition of green powder **A**.

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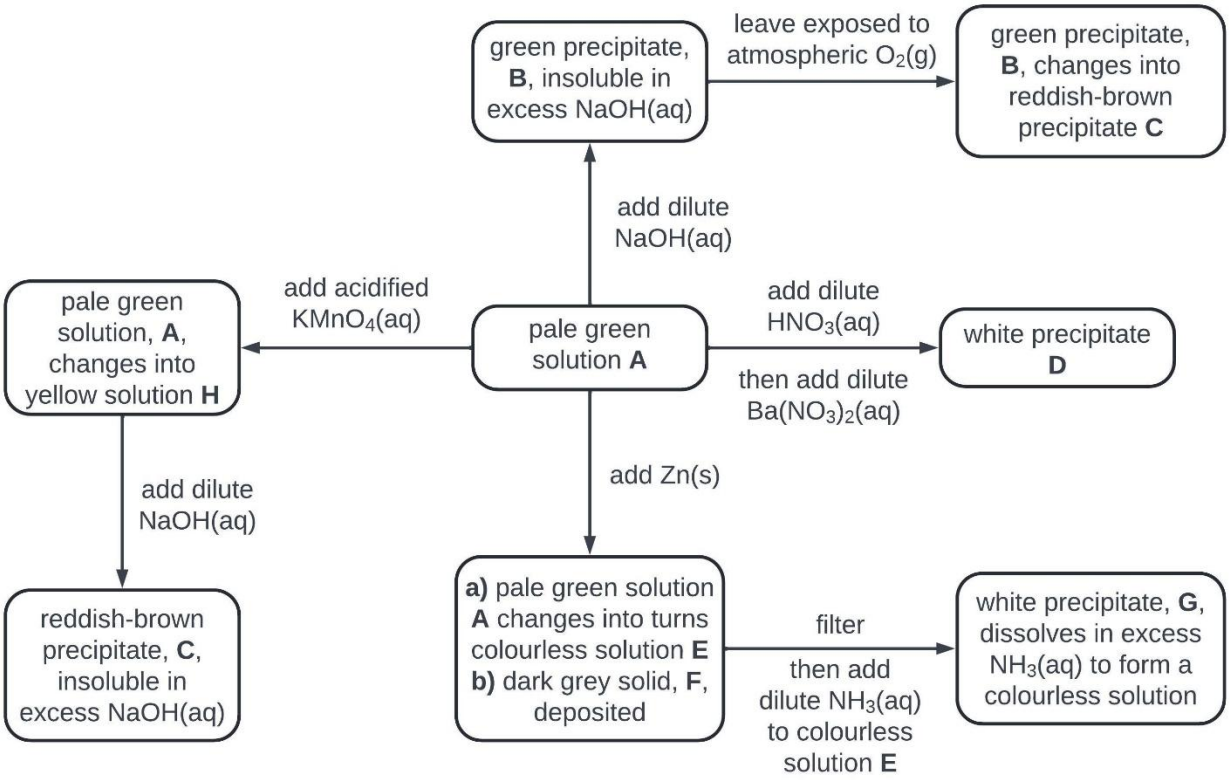
7. Unknown pale green solution **A** contains one cation and one anion. The reaction scheme below shows the results of some experiments that were performed on pale green solution **A**.



(a) **(i)** Identify the cation present in solution **A**. ……

(ii) Identify the anion present in solution **A**. ……

(b) Give the formula of precipitate **B**. ……

(c) Give the formula of precipitate **C**. ……

(d) Give the formula of precipitate **D**. ……

(e) Name solution **E**. ……

(f) Name solid **F**. ……

(g) Give the formula of precipitate **G**. ……

(h) Give the formula of the formula of the cation present in yellow solution **H**.

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(i) Write the ionic equation for the reaction between pale green solution **A** and dilute aqueous sodium hydroxide to form green precipitate **B**.

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(j) Write the balanced chemical equation for the reaction between pale green solution **A** and zinc to form colourless solution **E** and dark grey solid **F**.

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(k) In the reaction scheme shown, which *three* reactions are redox reactions?

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8. Solution **X** contains two cations and one anion.

Complete the table given below and hence identify the ions present in solution **X**.

Test	Description of Test	Observations	Conclusion
1.	Observe the solution.	The solution is pale green in colour.	
2.	To 1 cm^3 of solution **X** in a test tube, add dilute aqueous sodium hydroxide until no further change is seen.	A green precipitate is formed. The precipitate is insoluble in excess dilute aqueous sodium hydroxide.	
3.	To 1 cm^3 of solution **X** in a test tube, add dilute aqueous sodium hydroxide and then warm the mixture gently.		The ammonium ion, NH_4^+, is present.
4.		No observed reaction.	The chloride ion, Cl^-, is absent.
5.			The sulfate ion, SO_4^{2-}, is present.

- The two cations present in solution **X** are: …… and ……
- The one anion present in solution **X** is: ……

9. The label on an old reagent bottle in a school laboratory has faded, and cannot be read. The school's Chemistry Teacher tells her students that the bottle is supposed to contain a 1.0 mol dm^{-3} solution of zinc nitrate, and asks them to perform tests on the solution in the bottle to see if this is true.

Suggests the qualitative tests that the students should perform to confirm the presence of zinc ions and nitrate ions in the solution. Your answer should include appropriate volumes of solutions used, the names of suitable pieces of apparatus, clear descriptions of the tests and clear descriptions of the observations that should be made.

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- Scan the QR code for the answers to this assignment.

http://www.chemist.sg/qualitative_analysis/qa_assignment_8_ans.pdf