3.1.1 Inorganic qualitative analysis

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS flame test • precipitate • non-luminous flame

Objective

Answer inorganic qualitative-analysis questions with exact observations: flame-test method and colours, halide precipitates with ammonia confirmation, a red-herring separator for look-alike cations, and reading an ion-migration experiment. Original practice for WCH13's observation demands (Summer 2025 Q2–Q3 pattern).

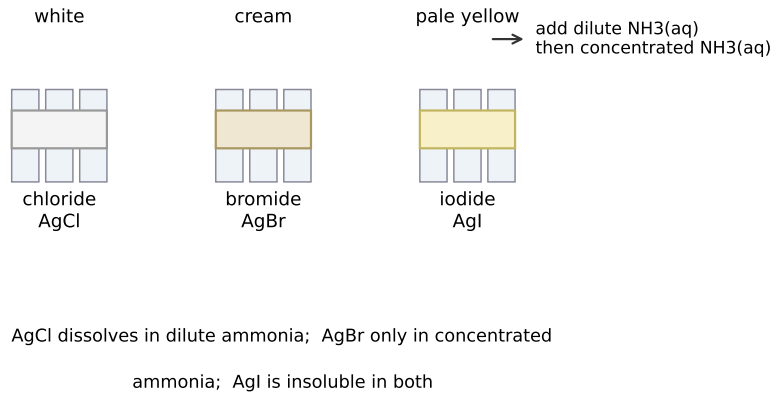
1 Key knowledge and worked examples

■ The flame test is a technique, then a colour

Clean a nichrome/platinum wire with concentrated hydrochloric acid and heat until flame-clean; dip the sample; hold it in the hottest **non-luminous (blue) flame** and name the colour. Wooden splints are cheaper and disposable (advantage) but the burning wood yellows the flame (disadvantage). Exact words: sodium yellow, potassium **lilac**, rubidium **red-violet** (not "purple"), calcium brick-red, strontium red, barium pale green, copper blue-green.

■ Halides: colour, then ammonia

Acidify with dilute nitric acid first, then add silver nitrate: chloride **white**, bromide **cream**, iodide **pale yellow** precipitate. Confirm with ammonia solution – AgCl dissolves in dilute NH_3(aq); AgBr only in concentrated; AgI in neither.



■ When two colours collide

Lithium and strontium both flame red – separate chemically: add a soluble sulfate (or dilute sulfuric acid); **$SrSO_4$ precipitates (white), Li_2SO_4 does not**. Choose a reagent whose solubilities differ; hydroxide is not credited.

■ Ions move under current

Filter paper wet with **tap water** (deionised water has almost no ions – it does not conduct): Ag^+ migrates to the cathode, CrO_4^{2-} to the anode, meeting as red Ag_2CrO_4. Chloride or hydrogencarbonate in the tap water may give a little white AgCl, but its ion concentration is too low to matter.

2 Practice

2.1 Describe how to carry out a flame test on a solid sample, from cleaning the wire to reading the colour. [2]

2.2 State the silver-nitrate precipitate colours for chloride, bromide and iodide ions, and the ammonia result that confirms each. [4]

2.3 Give one advantage and one disadvantage of wooden splints instead of platinum wire. [2]

2.4 In the filter-paper experiment, explain why tap water is used and why any white precipitate on the silver side does not prevent the red precipitate forming. [2]

3 Exam-style questions

3.1 Two unlabelled solutions contain lithium nitrate and strontium nitrate. Describe a chemical test to tell them apart, naming the reagent and the observations in each solution. [2]

3.2 Drops of 1.0 mol dm^{-3} silver nitrate and potassium chromate(VI) sit on filter paper soaked in tap water, electrodes at each end. Explain what the formation of a red precipitate in the centre shows about the two salts, including an equation, and state what is seen if the central spot is green copper(II) chromate instead. [5]

3.3 A student tests a halide with acidified silver nitrate and records “a solid appeared, soluble in some ammonia”. Explain why this record cannot identify the halide, and write the completed record for bromide. [3]