

Core Concepts: Qualitative tests for common gases (hydrogen, oxygen, carbon dioxide, chlorine) and ions (cations: Li^+ , Na^+ , K^+ , Ca^{2+} , Cu^{2+} , Al^{3+} , Fe^{2+} , Fe^{3+} ; anions: CO_3^{2-} , Cl^- , Br^- , I^- , SO_4^{2-}). Understanding reagents, observations, and chemical principles.

Section A: Key Terms & Concepts

- Complete the table below by identifying the correct test and observation for each gas.

Gas	Test	Observation
Hydrogen	_____	_____
Oxygen	_____	_____
Carbon dioxide	_____	_____
Chlorine	_____	_____

- Fill in the blanks to complete the sentences about ion identification tests.

- Flame tests are used to identify _____ based on the characteristic _____ they emit when heated in a flame.
- When testing for halide ions, _____ is added first to remove any _____ ions, followed by _____ solution.
- The test for carbon dioxide involves bubbling the gas through _____, which is a solution of _____.

Section B: Core Concepts & Explanations

- Describe the test for hydrogen gas, including the expected observation.

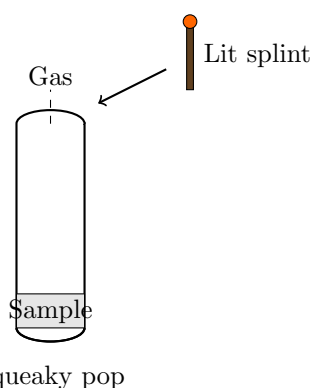


Figure 1: Test for Hydrogen Gas

- Explain the observations when testing for copper(II) ions using sodium hydroxide solution. Include a relevant ionic equation.

3. Outline the procedure and expected observations for distinguishing between chloride, bromide, and iodide ions.

4. Describe the steps and observations for testing for sulfate ions. Include a relevant ionic equation.

Section C: Exam Application & Extended Writing

1. A student tested three unknown solutions (A, B, and C) using various reagents. The results are shown in the table below.

Solution	Flame Test	NaOH Test	AgNO ₃ Test (after HNO ₃)
A	Lilac	No precipitate	White precipitate
B	Blue-green	Blue precipitate	No precipitate
C	Red	White precipitate	Cream precipitate

Identify the ions present in each solution (A, B, and C), providing reasoning for your answers.

2. Explain, in detail, how to test for carbonate ions and sulfate ions. For each test, describe the reagents used, the expected observations, and include any relevant balanced ionic equations. (6 marks)
