

CHAPTER 7	Investigation 7.A: Qualitative Analysis	BLM 7.1.7
HANDOUT		

In this investigation, apply your knowledge of chemical reactions and solubility to identify ions in solution.

### Question

What ions are in the unknown solutions A, B, C, and D?

### Predictions





Read the entire Procedure. Can you predict the results of any steps? Write your predictions in the space below. Justify each prediction.

### Safety Precautions





- Be careful not to contaminate the dropper bottles. The tip of a dropper should not make contact with either the plate or another solution. Put the cap back on the bottle immediately after use.
- Hydrochloric acid and sulfuric acid are corrosive. Wash any spills on your skin with plenty of cool water. Inform your teacher immediately.
- Part 2 of this investigation requires an open flame. Tie back long hair, and confine any loose clothing.
- When you have completed the investigation, wash your hands.

### Materials

#### Part 1

- unknowns: four dropper bottles (labelled A, B, C, and D) of solutions, each containing one of the following ions:  
 $\text{Na}^+(\text{aq})$ ,  $\text{Ag}^+(\text{aq})$ ,  $\text{Ca}^{2+}(\text{aq})$ , and  $\text{Cu}^+(\text{aq})$   
- reactants: two labelled dropper bottles containing dilute  $\text{HCl}(\text{aq})$  and dilute  $\text{H}_2\text{SO}_4(\text{aq})$   
- 12-well or 24-well plate, or spot plate

#### Part 2

- unknowns: solutions A, B, C, and D from Part 1  
- reactants: four labelled dropper bottles, each containing one of the following cations:  
 $\text{Na}^+(\text{aq})$ ,  $\text{Ag}^+(\text{aq})$ ,  $\text{Ca}^{2+}(\text{aq})$ , and  $\text{Cu}^{2+}(\text{aq})$   
- laboratory burner
- heat-resistant pad
- cotton swabs

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## Procedure

### Part 1 Using Acids to Identify Cations

1. Read Procedure Steps 2 and 3 on the following page. Design a suitable table for recording your observations.

2. Place one or two drops of each unknown solution into its own well or spot. Add one or two drops of hydrochloric acid to each unknown. Record your observations.
3. Repeat Procedure Step 2, but this time, test each unknown solution with one or two drops of sulfuric acid. Record your observations.
4. Answer Analysis Questions 1 to 5.

### Part 2 Using Flame Tests to Identify Cations

**Note:** Your teacher may demonstrate this part.

5. Read Procedure Steps 6 to 10. Design tables to record your observations.



4. Which cation(s) has a solution that is not colourless?
5. Based on your analysis so far, tentatively identify each unknown solution.
6. Use your observations of the flame tests to confirm or refute the identifications you made in Analysis Question 5. If you are not sure, check your observations and analysis with other students' results. If necessary, repeat some of your tests.

## Conclusion

7. Identify the unknown cations in this investigation. Explain why you do, or do not, have confidence in your decisions. What could you do to be more confident?