

Date _____ Name _____
Section _____ Team _____
Instructor _____

Pre-Lab Study Questions | 16

1. How can the presence of an ion in a solution be detected?

Ions can be detected by adding a substance that chemically reacts with the ion.

2. What tests would you use to identify a solution of Ag_3PO_4 ?

For the Ag^{1+} : add NaCl and HNO_3

For the PO_4^{3-} : add HNO_3 and $(\text{NH}_4)_2\text{MoO}_4$

3. What tests would you use to identify a solution of FeCl_3 ?

For the Fe^{2+} : add KSCN

For the Cl^{1-} : add AgNO_3

4. A flame test of a colorless solution gives a bright yellow color. When reacted with AgNO_3 a white precipitate forms that dissolves when HNO_3 is added. When HCl is added to the unknown solution, bubbles form. What is the compound in the colorless solution?

Flame test $\rightarrow \text{Na}^{1+}$

AgNO_3 test $\rightarrow \text{Cl}^{1-}$

HCl test $\rightarrow \text{N/A}$

unknown is NaCl

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REPORT SHEET | LAB

Testing for Cations and Anions

16

1. Unknown solution number: **Unknown X**

A. Flame Tests for K^+ , Ca^{2+} , and Na^+ ions

Cation Tested	Color produced
2. K^+	Pink-purple
3. Ca^{2+}	Orange-red
4. Na^+	Yellow-orange
5. Unknown	Purple

6. From your test results, does your unknown contain K^+ , Ca^{2+} , or Na^+ , or none of these?

 K

Explain your choice.

Unknown X flame test was purple colored

B. Tests for ammonium ion, NH_4^+ , and Iron(III) ion, Fe^{3+}

Cation	Test Results (Known)		Test Results (Unknown)	
	Odor	Color	Odor	Color
1. NH_4^+	Ammonia	Turns blue	No odor	No color change
2. Fe^{3+}	No odor	Dark red	No odor	Dark red

From your test results, does your unknown contain
 3. NH_4^+ or Fe^{3+} , or none of these?

Fe^{3+}

Explain your choice.

Unknown X was KSCN since the test caused a red color change.

C. Tests for Negative Ions (Anions)

Anion	Observations (Known)	Observations (Unknown Solution)
1. Cl^-	White solid forms, does not dissolve in HNO_3	White solid forms, does not dissolve in HNO_3
2. SO_4^{2-}	White solid forms, does not dissolve in HNO_3	White solid forms, dissolves in HNO_3
3. PO_4^{3-}	Yellow solid forms	No solid
4. CO_3^{2-}	Gas bubbles form	No bubbles

5. Identification of the negative ion in the unknown solution

From your test results, what negative ion (anion) is present in your unknown?

Cl^-

Explain your choice.

Unknown formed a white solid that did not dissolve in HNO_3

D. Writing the Formula of Your Unknown Salt

1. Cation Fe^{3+} Name **Iron (III) ion**
 Anion Cl^- Name **Chloride ion**

2. Formula of your unknown salt **FeCl_3**

3. Name of your unknown salt **Iron (III) chloride**

E. Testing Consumer Products for Some Cations and Anions

Product tested **Window cleaner**

Cation tests	Observations	Ion(s) present
Flame tests (Na^+ , K^+ , Ca^{2+})	NC	
NH_4^+	Odor, turns blue	NH_4^{1+}
Fe^{3+}	NC	
Anion tests		
Cl^-	White solid forms, does not dissolve in HNO_3	Cl^-
SO_4^{2-}	NC	
PO_4^{3-}	NC	
CO_3^{2-}	NC	

Questions and Problems

Q1 How do the tests on known solutions containing cations and anions make it possible for you to identify the cations or anions in an unknown solution?

When a test done on a known has the same results as the unknown, you can conclude you have the same ions present.

Q2 You have a solution that is composed of either NaCl or CaCl₂. What tests would you run to identify the compound?

The flame test would give different colors for each cation.

Q3 If a solution turns a deep red color with a few drops of KSCN, what cation is present?

Fe³⁺

Q4 A plant food contains (NH₄)₃PO₄. What tests would you run to verify the presence of the NH₄⁺ ion and the PO₄³⁻ ion?

For NH₄⁺: add NaOH, test with red litmus paper

For PO₄³⁻: add HNO₃ and (NH₄)₂MoO₄, look for yellow solid

Q5 Write the symbol of the cation or anion that gives each of the following reactions:

Cl¹⁻ **a.** Forms a precipitate with AgNO₃ that does not dissolve in HNO₃

CO₃²⁻ **b.** Forms a gas with HCl

Na¹⁺ **c.** Gives a bright, yellow-orange flame test

SO₄²⁻ **d.** Forms a precipitate with BaCl₂ that does not dissolve in HNO₃