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| Exp. No. 3 | Experiment/Subject Qualitative Analysis of cations | Date 9/25/2023 | Course & Chem 213 |
| Name Emmeen Keulash Ramesh | Lab Partner | Locker/Desk No. | Section No. 203 |

Qualitative Analysis of Cations

Reference: "An Experiments in Thinking Scientifically," D.J. Sardella J Chem Ed. 69 933 (1992)

Purpose: Analyze unknown solution that may contains ~~one~~ number ions in solution.

Purpose: analyze known and unknown solution may react differently experiment so we can be precaution such reaction.

Material: Fe^{3+} , Ni^{2+} , Mg^{2+} , Cu^{2+}

Procedure: In each experiment, average four test according to ~~the~~ lab manual picture.

First row of tubes will corresponds to rows on table.

First column of test tube is corresponding to column A on the data tables

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| Signature | Date | Witness/TA | Date |
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Produce

Known solution

1. Put 20 drops of the $(Fe(NO_3)_3)$ in the first four tubes.

2. do the same for another test tubes (5-16)

With solution.

3. put 4 drops of (NaI) in the first test tube

of caution solution repeat the same for another test tubes (5-16) with solution.

4. Write down the observe of reaction in the table record the color and amount of an precipitates.

Unknown solution -

1. Try find the cations in the unknown solution in the vial.

2. Repeat same step as the known solution. for 2 to 3.

3. Clean up - carefully pour all solution in the ~~solid~~ waste container, then dry and clean test tube and use of soap or acetone to remove residue.

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| | A | B | D | E |
|--|---|---|---|---|
| | 7.5% NaI | 0.25 M Na Fe(CN) ₂ | 0.25 M Dimethylglyoxime | 1 M NaOH |
| 1. 0.25 M Fe(NO ₃) ₃ | mix little yellow and orange. clear. | mix little yellow and orange but blue and little particle | dark yellow bubbles with mid amount of particles | little dark orange. clear. |
| 2. 0.1 M Ni(NO ₃) ₂ | Clear/no color | very little green with some particles. | pink but little amount of particles | clear but more particle that stucked in the tube |
| 3. 0.1 M Mg(NO ₃) ₂ | Clear/no color | yellow like color but no particles | clear, non particles | blue with lot particles no color |
| 4. 0.1 M Cu(NO ₃) ₂ | brown clear/ bubbles of particles stick with tube. | dark brown with high particles. | clear brown but some particles | little blue little particles |
| 5. Unknown | mad brown with more particles | dark brown with higher particles | clear non particles | mid blue and higher particles amount |

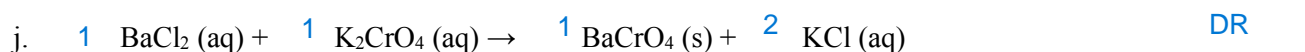
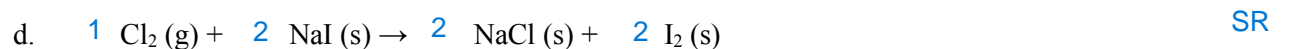
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Discussion: $\text{Cu}(\text{NO}_3)_2$ is the unknown liquid that was given to my instructor. I was able to identify the unknown chemical through the similar types of reactions that occurred in the five known chemicals, such as $\text{Fe}(\text{NO}_3)_3$, $\text{Ni}(\text{NO}_3)_2$, $\text{Mg}(\text{NO}_3)_2$, and $\text{Cu}(\text{NO}_3)_2$, which are reacted based on different chemicals that were added. Unknown and $\text{Cu}(\text{NO}_3)_2$ have similar reactions with other chemicals such as 7.5% NaI will react and form a yellowish liquid with some precipitate, $\text{Na}_4\text{Fe}(\text{CN})_6$ is reacted and forms dark brown with a higher amount of precipitate, Dimethylglyoxime doesn't change its appearance or create precipitate, and 1 M NaOH reacts and changes its color of light blue with no precipitate. These are reactions that include the unknown chemical $\text{Cu}(\text{NO}_3)_2$.

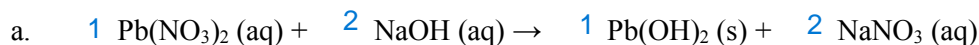
Conclusion: The experiment's purpose is to determine the known and unknown ions so that precautions can be performed before the experiments. Goals were achieved by observing several types of chemicals react to the known to determine the unknown. And see if it can be a precaution before an experiment that will be conducted in the future. Expect that chemicals can change their physical appearance and form some or higher level of precipitation. The most of solutions reacted and changed their colors but some of them were clear when they reacted with 0.25 Dimethylglyoximes. The Unknown had related the same types of reaction as $\text{Cu}(\text{NO}_3)_2$ which has been predicted as the unknown solution. In future experiments, there needs to be careful and mindful about the types of chemicals that react and strictly follow the table content.

1. Balance and classify the following reactions: combination (C), decomposition (D), single replacement (SR), double replacement (DR) or combustion (CB).

Classification

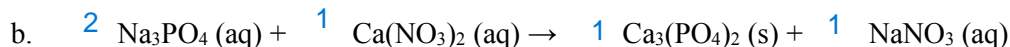


2. Balance each of the following equations. Then write the total (complete) ionic equation for each reaction. Finally write the net ionic equation for each reaction. **Remember: insoluble substances are not present as separate ions in solution.**



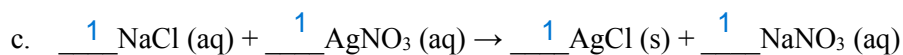
Complete Ionic equation: $\text{Pb}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq}) + 2\text{OH}^-(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Pb(OH)}_2(\text{s}) + 2\text{Na}^+ + 2\text{NO}_3^-$

Net ionic equation:



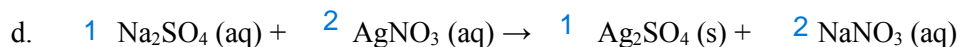
Complete Ionic equation: $2\text{Na}^+ + 3\text{PO}_4^{3-} + 3\text{Ca}^{2+} + 6\text{NO}_3^- \rightarrow \text{Ca}_3(\text{PO}_4)_2 + 6\text{Na}^+ + 6\text{NO}_3^-$

Net ionic equation: $\text{Cl}^- + \text{Ag}^+ \rightarrow \text{AgCl}$



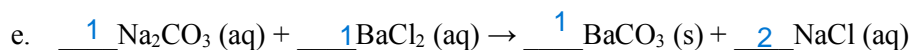
Complete Ionic equation: $\text{Na}^+ + \text{Cl}^- + \text{Ag}^+ + \text{NO}_3^- \rightarrow \text{AgCl} + \text{Na}^+ + \text{NO}_3^-$

Net ionic equation: $\text{Cl}^- + \text{Ag}^+ \rightarrow \text{AgCl}$



Complete Ionic equation: $\text{Na}_2^{2+} + \text{SO}_4^{2-} + 2\text{Ag}^+ + 2\text{NO}_3^- \rightarrow \text{Ag}_2\text{SO}_4 + 2\text{Na}^+ + 2\text{NO}_3^-$

Net ionic equation: $\text{SO}_4^{2-} + 2\text{Ag}^+ \rightarrow \text{Ag}_2\text{SO}_4$



Complete Ionic equation: $\text{Na}_2^{2+} + \text{CO}_3^{2-} + \text{Ba}^{2+} + 2\text{Cl}^- \rightarrow \text{BaCO}_3 + 2\text{Na}^+ + 2\text{Cl}^-$

Net ionic equation: $\text{CO}_3^{2-} + \text{Ba}^{2+} \rightarrow \text{BaCO}_3$



Complete Ionic equation: $\text{Na}_2^{2+} + \text{CO}_3^{2-} + 2\text{H}^+ + 2\text{Cl}^- \rightarrow 2\text{Na}^+ + 2\text{Cl}^- + \text{H}_2\text{O} + \text{CO}_2$

Net ionic equation: $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{H}_2\text{O} + \text{CO}_2$