Complexation and precipitation reactions

1. Evaluation of the complexation reaction based on the change in colour. Complexes and acidity.

1.1. Add a few drops of Fe^{3+} solution ions to a test tube containing several drops of NH_4SCN. Then add a few drops of NH_4F solution. Discoloration of the solution indicates the complexation of Fe^{3+} ions by fluorides. Then add cautiously of the solution of concentrated H_2SO_4, until the solution becomes red again. It indicates the presence of the Fe^{3+} complex in the thiocyanate solution.

1.2. Add a few drops of 2 M NH_3 solution to the solution containing Cu^{2+} ions. The dark blue colour of the solution indicates the presence of the copper-ammonia complex. Then carefully add 2 M HCl dropwise and observing the color change of the solution.

1.3. Add a few drops of 2 M NH_3 solution to the solution containing Ni^{2+} ions. The blue colour of the solution indicates the presence of the nickel-ammonia complex. Then carefully add 2 M HCl dropwise and observing the colour change of the solution.

Compilation of the results:

✓ Write complexation reactions and fill in the table below.

No.	*Me^{n+}*	*Complex formula*	*Colour*
1			
2			
3			

2. Sensitivity of the complexation reaction

First step. Prepare a series of Fe^{3+} solutions at concentrations of 10^{-1}, 10^{-2}, 10^{-3}, 10^{-4}, 10^{-5} and 10^{-6} mol/dm^3 using successive dilutions method. Prepare 8 cm^3 of each solution. Then add 1 cm^3 of NH_4SCN solution and 1 cm^3 of concentrated HCl to each test tube and shake thoroughly (iron standard solutions were obtained).

Second step. Add 1 cm^3 of NH_4SCN solution and 1 cm^3 of concentrated HCl to 8 cm^3 of tap water.

Compilation of the results:

✓ Based on the observation of the colour of iron standard solutions obtained and the colour of tap water answer the question: how much iron (μg) is in a glass of tea (250 cm^3)?

3. Precipitation reactions

3.1. Add approximately 1 cm^3 of $AgNO_3$ into five test tubes. Then:

Add a few drops of HCl to the first test tube.

Add a few drops of NaOH to the second test tube.

Add a few drops of KBr to the third test tube.

Add a few drops of KI to the fourth test tube.

Add a few drops of K_2CrO_4 to the fifth test tube.

Note the colors of the precipitates.

3.2. Add approximately 1 cm^3 of $Pb(NO_3)_2$ into the test tube and then add a few drops of KI. A yellow precipitate of PbI_2 will form. Add water and heat the mixture - the precipitate will dissolve. Cool the test tube with the lead iodide in a beaker of cold water. After cooling down, PbI_2 was again released as gold plates or gold glitter.

3.3. Amphotericity and precipitation reactions. Add a few drops of Al^{3+} ion solution to the test tube. Then add dropwise a solution of 0.1 M NaOH. Then divide precipitate into two test tubes. In first test tube dissolve the precipitate by adding further portions of 0.1 M NaOH, in second test tube dissolve the precipitate by adding 2 M HCl.

Optional repeat the experiment for the following cations: Zn^{2+}, Pb^{2+}.

Compilation of the results:

- ✓ Write precipitation reactions,
- ✓ describe the phenomena occurring during the experiments in point 3.3.

4. The scope of the material

- ☐ Structure of the coordination compounds,
- ☐ role of ligands and metal ions in the formation of complexes,
- ☐ nomenclature of chemical complexes,
- ☐ solubility equilibrium and solubility (Ks and s),
- ☐ salt effect, common ion effect,
- ☐ amphotericity and precipitation reactions.

5. Literature

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