SUMY STATE UNIVERSITY

LABORATORY WORKS

OF

MEDICAL CHEMISTRY

SUMY 2020

LABORATORY WORK № 1

Coordination compounds

Purposes: 1. To aquaint with the different types of coordination compounds (complex).
2. To aquaint with the chemical properties and preparation of complex compound.

Experiment 1. ***Preparation and properties of complex compound of copper***

(I) Test for copper (II) sulfate.

Take two test-tubes. Place 4-8 drops of copper (II) sulfate $CuSO_4$ solution into each test-tube. Add 2-3 drops of barium chloride $BaCl_2$ into the first test-tube. Observe the formation of white precipitate. In the second test-tube place the piece of tin *Sn*. Tin dissolves gradually and red-brown copper is displaced. Write the reaction equations.

$CuSO_4 + BaCl_2 \rightarrow$ _____

$CuSO_4 + Sn \rightarrow$ _____

(II) Preparation of complex of tetraamminecopper (II).

Place 10-15 drops of $CuSO_4$ solution in a clean test-tube. Add a few drops of ammonia solution NH_4OH. At first we can observe the formation of blue-green precipitate of $(CuOH)_2SO_4$ which will be dissolved in the excess of NH_4OH with the formation of $[Cu(NH_3)_4]^{2+}$ ions colored blue. Write the reaction equations and balance it.

$CuSO_4 + NH_4OH \rightarrow (CuOH)_2 SO_4 + ...$ _____

$(CuOH)_2 SO_4 + NH_4OH \rightarrow [Cu(NH_3)_4] SO_4 +$

$+ [Cu(NH_3)_4](OH)_2 + ...$ _____

(III) Properties of complex compound of copper.

Solution of complex of tetraamminecopper (II) divide into two equal parts. Add 2-3 drops of $BaCl_2$ into the first test-tube and *Sn* into the second one. Observe the formation of white precipitate in the first test-tube and absence of free copper in the second one.

$\left[Cu\left(NH_3\right)_4\right]SO_4 + BaCl_2 \rightarrow$ _____

Experiment 2. ***Complex compound in the exchange reactions***

Take two test-tubes. Place 4-5 drops of $K_4[Fe(CN)_6]$ solution into each test-tube. Add 4-5 drops of $CuSO_4$ solution into the first test-tube. In the second test-tube add 4-5 drops of $FeSO_4$. Observe the formation of precipitate. Write the reaction equations.

$K_4\left[Fe\left(CN\right)_6\right] + CuSO_4 \rightarrow$ _____

$K_4\left[Fe\left(CN\right)_6\right] + Fe_2(SO_4)_3 \rightarrow$ _____

Experiment 3. ***Preparation of hydroxocomplex compounds***

(I) Place 8-10 drops of $AlCl_3$ solution in a test-tube. Add a few drops of *NaOH*. Observe the formation of white precipitate of aluminium hydroxide $Al(OH)_3$ which is amphoteric, dissolving in excess *NaOH*. Write the reaction equations.

$AlCl_3 + NaOH \rightarrow$ _____

$Al\left(OH\right)_3 + NaOH \rightarrow$ _____

(II) Repeat analogical experiments with solutions of $Cr_2(SO_4)_3$. Write the reaction equations.

$Cr_2\left(SO_4\right)_3 + NaOH \rightarrow$ _____

$Cr\left(OH\right)_3 + NaOH \rightarrow$ _____

LABORATORY WORK № 2

Solutions

Purposes: Preparation of solution.

How would you prepare a 50g of 1% solution $K_2Cr_2O_7$?

1. Calculate the number of grams $K_2Cr_2O_7$ contained in solution.
2. Calculate the volume of water $\left(\rho_{H_2O} = 1\ g/ml\right)$.
3. Put the data into Tab.1

mass of solution	percent concentration	mass of solute m ($K_2Cr_2O_7$)	mass and volume of water m (H_2O), V (H_2O)	density (ρ)	Molar concentration C_M	Molal concentration C_m
50g	10%					

4. Weigh out $K_2Cr_2O_7$ and take distilled water into the measuring cylinder. Dissolve the salt in water into the breaker.
5. Pour the solution from the beaker into the cylinder.
6. Measure the density of solution by aerometer.
7. Calculate the molarity and molality of this solution.

LABORATORY WORK №3
Oxidation – Reduction Reactions

Objective: experimentally investigate redox process.

Experiment 1. *$(NH_4)_2Cr_2O_7$ Decomposition*

Instructions

Put some microspatulas of $(NH_4)_2Cr_2O_7$ into a test – tube. Heat the bottom of the test – tube for 0.5 minute. Observe the appearance of green flakes of Cr_2O_3 and the evolution of N_2 with water vapor.

How to fix the experimental data

1. Write the equation of the reaction. Write the electron balance and put the coefficients and point out the oxidation and the reductant.

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Experiment 2. *Medium influence on redox process*

Instructions

1. Take three test – tubes. Put 3–4 drops of $KMnO_4$ solution into each test – tube.
2. Produce a respective medium in each test – tube adding 2–3 drops of H_2SO_4 (pH < 7) into the first one; 2–3 drops of distilled water (pH = 7) into the second one; 2–3 drops of KOH (pH > 7) solution into the third one.
3. Add 2 microspatulas of cristal KNO_2 into each test – tube and stir up to the full solution of the cristals.
4. Observe the change of the coloring in each test – tube. Pay attention to the tube with the alkaline medium as the initial coloring changes very quickly as the result of desproportion.

How to fix the experimental data

1. Write the reactions of reduction of $KMnO_4$ with KNO_2 in the acid, neutral and alkaline media. First, consider that under the experimental conditions KNO_2 is oxidized up to KNO_3; second,

note that manganese compounds have different coloring due to the oxidation state:

- permanganate – anion MnO_4^- in a diluted solution is pink, but with strengthening of may change up to violet (purple);
- manganate – anion MnO_4^{2-} is bright green;
- oxide MnO_2 – insoluble compound of a brown coloring.

Write the equations of electron balance, put the coefficients, point out the oxidant and the reductant, the processes of oxidation and reduction:

In the acid medium:

_____

_____

In the neutral medium:

_____

_____

In the alkaline medium:

_____

_____

Experiment 3. ***$K_2Cr_2O_7$ reduction with ethyl alcohol***

Instructions

Put 5–6 drops of $K_2Cr_2O_7$ solution into a test – tube; add 2–3 drops of concentrated sulfuric acid H_2SO_4 with density 1.84 g/ml. Add 4–5 drops of ethyl alcohol C_2H_5OH and observe the change of the coloring and smell the specific odor.

How to fix the experimental data

1. Write the equation of $K_2Cr_2O_7$ reduction with ethyl alcohol up to acetaldehyde CH_3COH

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