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## LABORATORY WORK NO. 17

### COORDINATION COMPOUNDS

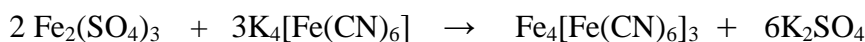
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- **PRINCIPLE:** Coordination compounds (complex compounds) are substances whose molecules consist of *central atoms* on which other atoms, molecules and ions (called *ligands*) are bound coordinatively. When the coordination bond forms, the central atom is an *acceptor* and the ligand is a *donor* of electron pairs. Coordination compounds can be formed for example by reactions of poorly soluble substances with substances which are well soluble.

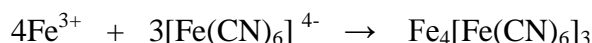
#### TASK NO. 1 PREPARATION OF THE PRUSSIAN BLUE $Fe_4[Fe(CN)_6]_3$

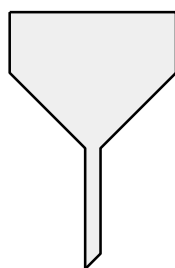
- **CHEMICALS:**  $Fe_2(SO_4)_3$  (10% of solution),  $K_4[Fe(CN)_6] \cdot 3H_2O$  (10% of solution),  $H_2SO_4$  (c=1 mol/l), distilled water
- **AIDS:** 2 beakers (250ml), scales, weighing boat, stirring rod, pipette, Büchner funnel, suction flask, filter paper, drier
- **PROCEDURE:** Dissolve 1g of  $Fe_2(SO_4)_3$  in distilled water, 10% solution should arise. Add 2 ml of sulphuric acid to restrain hydrolysis. Prepare an appropriate amount of 10% solution of  $K_4[Fe(CN)_6] \cdot 3H_2O$  in the other beaker. Add gradually the solution of  $K_4[Fe(CN)_6]$  into the solution of the ferric sulfate (not reversely, it would cause creation of  $KFe[Fe(CN)_6]$  solution). After precipitation, suck up the obtained Prussian blue on the Büchner funnel on a filter weighed in advance and wash it with distilled water as long as you see that a blue solution flows. Dry the product in the drier at  $105^\circ C$  and then weigh it.

The reaction proceeds according to the equation:

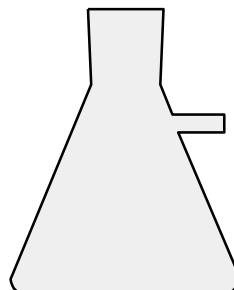


or in the ionic form:





A



B

A – Büchner funnel, B – separation flask

- **CALCULATIONS:** Calculate the relative yield and fill in the table of the material balance.

$$R = \frac{SV}{TV} \cdot 100\%$$

Compounds	Mr	M (g)	Note
Fe <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>		1g	10% solution
K <sub>4</sub> [Fe(CN) <sub>6</sub> ].3H <sub>2</sub> O			10% solution
Fe <sub>4</sub> [Fe(CN) <sub>6</sub> ] <sub>3</sub>			TY
Fe <sub>4</sub> [Fe(CN) <sub>6</sub> ] <sub>3</sub>			Real Y

- **CONCLUSION:** Write the calculated values of TY, RealY, RY

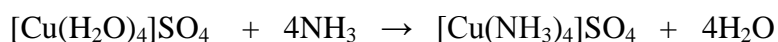
**TASK NO. 2: PREPARATION OF COORDINATION COMPOUNDS OF IRON AND SILVER AND THEIR STABILITY**

- **CHEMICALS:** CuSO<sub>4</sub>.5H<sub>2</sub>O (solid), NH<sub>3</sub> (25% solution), FeCl<sub>3</sub> (5% solution), KSCN (5% solution), KF (5% solution), AgNO<sub>3</sub> (c=0,1 mol/l), K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (5% solution), CH<sub>3</sub>COOH (c=2mol/l)

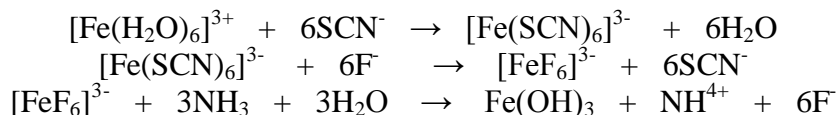
- **AIDS:** spotted plate, pipette, dropper

■ **PROCEDURE:**

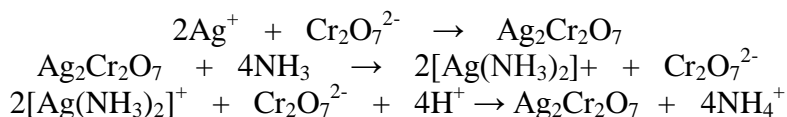
a) Put a few crystals of CuSO<sub>4</sub>.5H<sub>2</sub>O on the spotted plate and add a few drops of water to dissolve cupric sulfate. Then add the concentrated solution of ammonia and observe the change of colour.



b) Add a few drops of KSCN solution onto the yellow solution of ferric chloride, red bloody colouring documents the presence of a ferrous compound. Add a few drops of KF solution, potassium hexa fluoro ferrate arises. Fluoro komplex can be dissolved by adding a few drops of concentrated solution of ammonia and the brown sediment of Fe(OH)<sub>3</sub> arises.



c) Add a few drops of K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solution onto the solution of silver nitrate, a sediment of red brown Ag<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> arises. An insoluble complex of diamine silver will arise by the effect of concentrated solution of ammonia. Using the acetic acid, it is possible to transfer it back to the previous silver dichromate.



- **CONCLUSION:** Write down the names and colours of all created compounds.
- **SAFETY:** Potassium dichromate is harmful in contact with the skin. It is toxic and it can cause death after eating it. Be careful and use protective clothes and means.



## STUDENT'S SHEET No. 17 COORDINATION COMPOUNDS

### 1. Translate these vocabulary:

rozpustit  
reakce  
roztok  
nálevka  
koordinační sloučenina  
rovnice  
několik kapek  
stálost  
kapátko  
kyselina sírová  
téct  
sušit  
koncentrovaný  
kyselina octová

### 2. Make sentences

of / add / a / solution / drops / few

-----  
plate / there / crystals / spotted / few / on / are / a / the /

-----  
the / equation / proceeds / reaction / this / by

-----  
contain / compounds / substances / are / molecules / coordination

### 3. Complete the text with these words:

**Coordination      formed      bond      molecules      where      by reactions of**

\_\_\_\_\_ compounds (complex compounds) are substances containing molecules. Molecules consist of *the central atoms* \_\_\_\_\_ there are others coordination atoms, \_\_\_\_\_ or ions called *ligands*. When the coordination \_\_\_\_\_ forms there is a central atom as an *acceptor* and ligand as a *donor* of electron pairs. Coordination compounds can be \_\_\_\_\_ for example \_\_\_\_\_ poorly soluble substances with substances which are well soluble.