

LABORATORY WORK NO.12

REDOX REACTIONS II

- PRINCIPLE:** Iron is a non-noble metal located in the metal electrochemical series left from hydrogen, it displaces copper as the noble metal from its manganese solution.

$$\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Fe}^{2+} + \text{Cu}$$

This process is called cementation. It is typical for manganese that it has different oxidation numbers in its compounds - from III to VII. The most common are the compounds of manganese in oxidation numbers II, IV, VI and VII. Compounds with low oxidation number have reduction capability. Oxidation capabilities are gradually intensified by increasing the oxidation number.

TASK I. PREPARATION OF COPPER BY CEMENTATION

- CHEMICALS:** 5% CuSO₄ solution, iron nails, 5% H₂SO₄, ethanol, distilled water
- AIDS:** two 100 ml beakers, scales, spoon, weighing boat, rod, stand, burner, filter paper, filter ring, funnel
- PROCEDURE:** Prepare the 5% solution of CuSO₄ from copper sulfate pentahydrate, assume theoretical yield of copper (TY) 1 gram. Heat up the solution of CuSO₄ to the boiling point. Dip 5 iron nails into the solution. Knock and scrape off the excluded copper until the solution turns green (FeSO₄). Remove the nails and decant the mixture twice by hot distilled water. Add a few ml of 5% H₂SO₄ and heat up to the boiling point (Fe changes into FeSO₄). Decant the mixture twice again by hot distilled water and filter through the previously weighed filter paper. Pour ethanol over copper, dry it and weigh (real Y). Calculate the relative yield (RY). Fill in the table of material balance.

- CALCULATIONS:** $R = \frac{SV}{TY} \cdot 100\%$

Substance	Mr	m(g)	Note
CuSO ₄			-
CuSO ₄ ·5H ₂ O			5% solution
Fe			nails
Cu theoretical		1	TY
Cu extracted			SV



- **CONCLUSION:** Calculate the real and relative yields of the copper cementation.

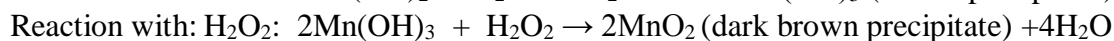
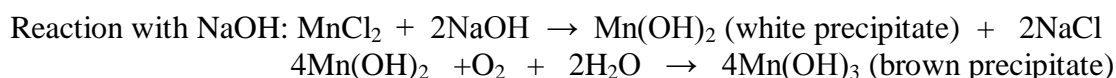
TASK 2. PREPARATION OF MANGANESE COMPOUNDS IN DIFFERENT OXIDATION STATE

- **CHEMICALS:** 5% MnCl₂ solution, NaOH (2 mol/l), 10% solution of H₂O₂, KMnO₄ (0.02 mol/l), MnO₂ powder, KOH (2 mol/l), concentrated HCl.

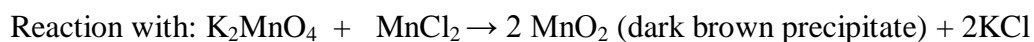
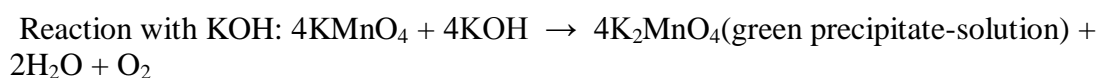
- **AIDS:** 2 test tubes, pipette, spoon

- **PROCEDURE:**

Pour 5 ml of 5% MnCl₂ solution into the first test tube. Using a pipette, carefully add 2 ml of NaOH solution (2 mol/l) – put the pipette on the bottom. Observe the reaction on the interface of both liquids. Add a few drops of 10% H₂O₂ to the arised precipitate. A dark brown MnO₂ precipitate appears.



Pour 2 ml of KMnO₄ (0.02 mol/l) into the second test tube. Add 1 ml of KOH solution (2 mol/l). After a while, the solution turns green. Add a small amount of 5% MnCl₂ solution to the green K₂MnO₄ solution. A brown MnO₂ precipitate appears.



- **CONCLUSION:** Write down the changes in oxidation numbers of manganese for all observed reactions.
 - **SECURITY:** Concentrated HCl is a corrosive substance and therefore use protective equipment during work.
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STUDENT'S SHEET No. 12

REDOX REACTIONS II

1) Spelling/Word search:

1. _O_RO_IV_ žíravý
2. C__P__N_ sloučenina
3. __P__R měď
4. P__C_P__A__ sraženina
5. __NN__ nálevka
6. __M__T_____ cementace
7. Yl___ výtěžek

2) Correct spelling – filling in the text

1. The process of heating two substances in contact in order to effect some change in one of them, esp. the formation of steel by heating iron in powdered charcoal is called -----
a) cementery b) cementing c) centralization d) cementation
2. ----- is a paper used for filtering liquids
a) filter paper b) flicker paper c) filtred paper d) filtering paper
3. A ----- is a small glass tube used in chemistry with one closed and rounded end.
a) test tuba b) test tube c) tumbler d) vase
4. A ----- is a laboratory aid commonly used to transport a measured volume of liquid.
a) bucket b) cup c) pipette d) test tube
5. ----- is water that has been purified by distillation
a) destiled water b) destil water c) distillery water d) distilled water



3) Vocabulary Czech – English from the text

Translate:

1. Modrá skalice
2. Filtrační papír
3. Oklepat
4. Řada napětí kovů
5. Mangan
6. Získaný
7. Seškrábat
8. Hřebíky

4. Easy crossword:

Pozorovat:

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Roztok:

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Rozhraní (dvou kapalin):

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Kapky:

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Kádinka:

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Slít, scedit, dekantovat:

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