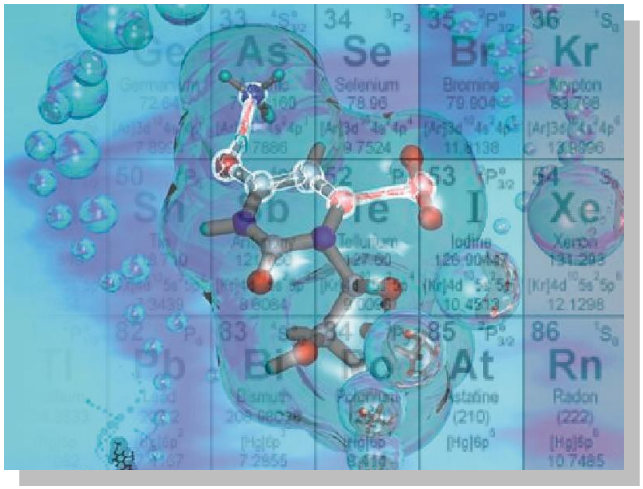
Associate professor, PHD,
OSTVALD ROMAN

BASICS OF ANALYTICAL CHEMISTRY



Electrochemical Cells

Galvanic Cells

GALVANIC CELLS

anion, n ['ænaiən]

practical unit of quantity in measuring electricity

galvanism, n

not bound by rules

joule, n

electro-negative ion

cation, n ['kætaiən],

unit of measuring electric resistance

unit of work or energy

arbitrary, adj

positive ion

ohm, n

coulomb, n ['kuləm]

electricity produced by chemical action

GALVANIC CELLS

Look the movie
"Galvanic cells"
http://www.youtube.com/watch?v=A0VUsoeT9aM
and discuss next questions

- ✓ *What is a galvanic cell?*
- ✓ *What is the difference between a galvanic cell and electrolytic one?*
- ✓ *Would you describe the electrolytic cell operation?*
- ✓ *What is called the anode?*
- ✓ *What is called the cathode?*

GALVANIC CELLS

Look through the text "Galvanic cells" ex. 5, p.33 and correct these statements

1. The electrode, at which oxidation takes place in the electrochemical cell, is called the cathode.

2. The electrode at which reduction occurs is called the anode.

3. The identity of the cathode and anode can be remembered by recognizing that positive ions, or anions, flow toward the cathode, while negative ions, or cations, flow toward the anode.

GALVANIC CELLS

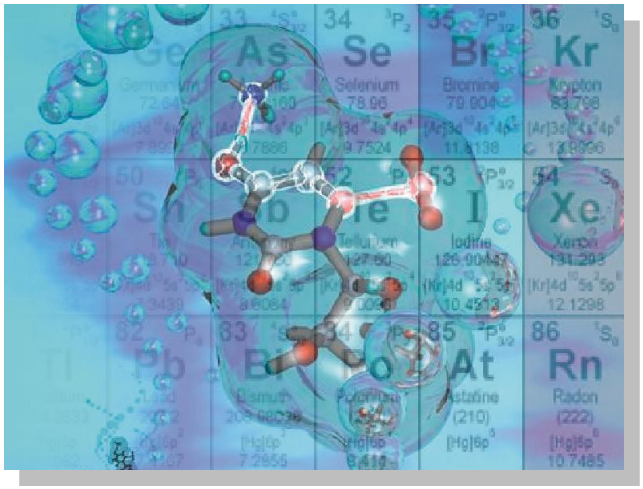
Read information in ex. 10, p. 35 and carry out the following task

Write oxidation and reducing processes and the overall reaction based on schematic representations of the following electrochemical cells

$Ti/Ti^{2+}//Cu^{+}/Cu$	
Oxidation process	
Reduction process	
General reaction	
Ni/Ni2+//Ce4+, Ce3+/Pt	
Oxidation process	
Reduction process	
General reaction	
La3+/La//Pt2+/Pt	
Oxidation process	
Reduction process	
General reaction	

Associate professor, PHD,
OSTVALD ROMAN

BASICS OF ANALYTICAL CHEMISTRY



Electrochemical Cells

Electrolytic Cells

ELECTROLYTIC CELLS

Coordinate the words in "A" with their definitions in "B"

1. Electrolyte	a) It is a finally divided coating for platinum
2. Gain	b) It is a liquid where electrolysis takes place
3. Ignore	c) Obtain, acquire
4. E.m.f.	d) Disregard, leave out of account
5. Arrangement	e) Electromotive force
6. Platinum black	f) Order, disposition, plan

ELECTROLYTIC CELLS

Look the movie "Electrolytic Cells"
http://www.youtube.com/watch?v=lVK8RxkmOec
and discuss next questions

- ✓ ***What is called the electrolytic cell?***
- ✓ ***Do the terms "Galvanic cell" and "Electrolytic cell" have the same meaning?***
- ✓ ***If there is any difference between them, explain it.***
- ✓ ***For what methods are electrolytic cells very important?***

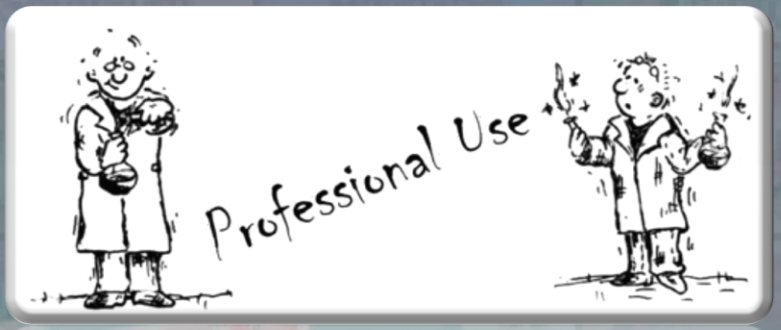
ELECTROLYTIC CELLS

Read the text "Electrolytic Cells" (ex. 3, p. 42) and discuss the following questions again

- ✓ ***What is called the electrolytic cell?***
- ✓ ***Do the terms "Galvanic cell" and "Electrolytic cell" have the same meaning?***
- ✓ ***If there is any difference between them, explain it.***
- ✓ ***For what methods are electrolytic cells very important?***

ELECTROLYTIC CELLS

Read the text (ex. 7, p. 44) and carry out tasks in ex. 8, p.45 and ex.9, p. 46

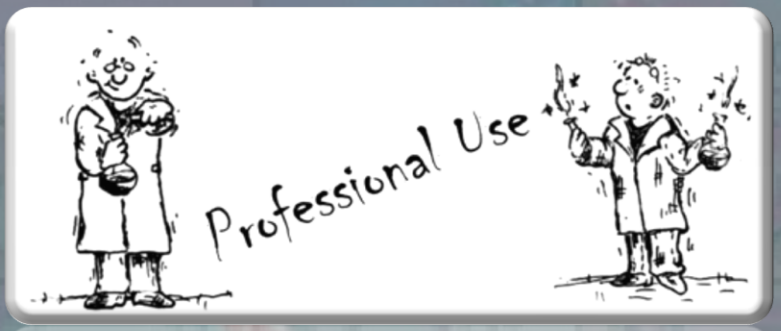


9. Make up schematic representations of galvanic cells in which the following chemical reactions proceed:

- $Cu + 2I^- \rightarrow I_2 + Cu^{2+}$;
- $Ni + Hg^{2+} \rightarrow Ni^{2+} + Hg$;
- $Tl + 2H^- \rightarrow Tl^+ + H_2$;
- $Cd + Ni^{2+} \rightarrow Cd^{2+} + Ni$;
- $La + Pb^{2+} \rightarrow La^{3+} + Pb$

ELECTROLYTIC CELLS

Read the text (ex. 7, p. 44) and carry out tasks in ex. 8, p.45 and ex.9, p. 46

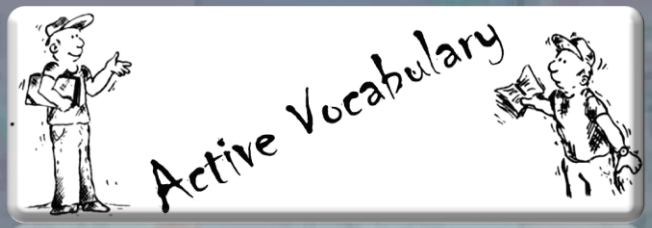


8. Calculate the electromotive force (e.m.f.) [potential] of the following electrochemical cells:

Schematic representations of the electrochemical cells:

- $Ni/Ni^{2+}//Cl^{-}/Cl_2$, Pt;
- $Mo/Mo^{3+}//Hg^{2+}$, Hg^{+}/Pt;
- $K/K^{+}//Pt^{2+}/Pt$;
- $Ti/Ti^{2+}//Au^{3+}/Au$;
- $Au/Au^{3+}//OH^{-}/O_2$, Pt;
- Cl_2/Cl^{-}, $Pt//Li^{+}/Li$

ELECTROLYTIC CELLS



Coordinate the words in "A" with their definitions in "B"

A	B
1. Solvent	a) Long narrow piece, take covering
2. Arbitrary	b) Strongly effectively
3. Species	c) Gloomy, tedious, dark, dim
4. Steam	d) Resisting wear, lasting
5. Perpetual	e) Vapour
6. Durable	f) Random, casual
7. Dull	g) Continuous, lasting for ever
8. Drastically	h) Sort, kind, sub-division
9. Strip	i) Liquid with power of dissolving

ELECTROLYTIC CELLS

Read the text "Electrolysis of Water" (ex. 5, p. 51) and explain the meanings of the word combinations given in bold

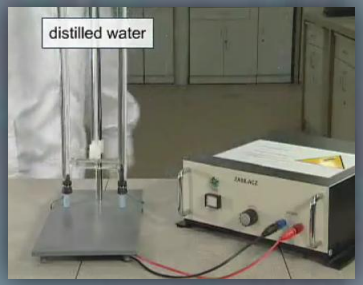
Quote the text to prove that

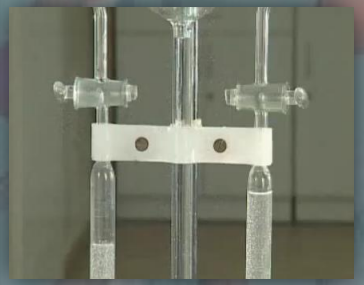
- ✓ *Electrolysis of water can be achieved in a simple hands-on project.*
- ✓ *Large quantities of hydrogen can significantly contaminate the electrolytic cell.*
- ✓ *The energy efficiency of water electrolysis varies widely*

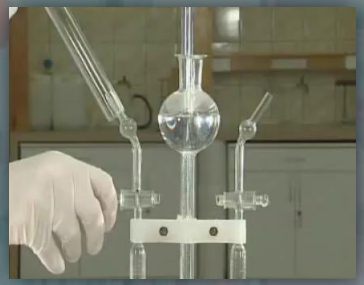
ELECTROLYTIC CELLS

Oral Practice

Look the movie
"Electrolysis of Water"
http://www.youtube.com/watch?v=OTEX38bQ-2w
and discuss it







ELECTROLYTIC CELLS

Read the information about Faraday's laws (ex. 9, p. 53).

- ✓ *Explain the first Faraday's law of electrolysis*
- ✓ *Explain the second one*
- ✓ *Explain next formulas*

$$m = \frac{Q}{qn} \cdot \frac{M}{N_A} = \frac{1}{qN_A} \cdot \frac{QM}{n} = \frac{1}{F} \cdot \frac{QM}{n} = \frac{1}{96.485C} \cdot \frac{QM}{n}$$

$$Q = \int_0^T I(t)dt$$

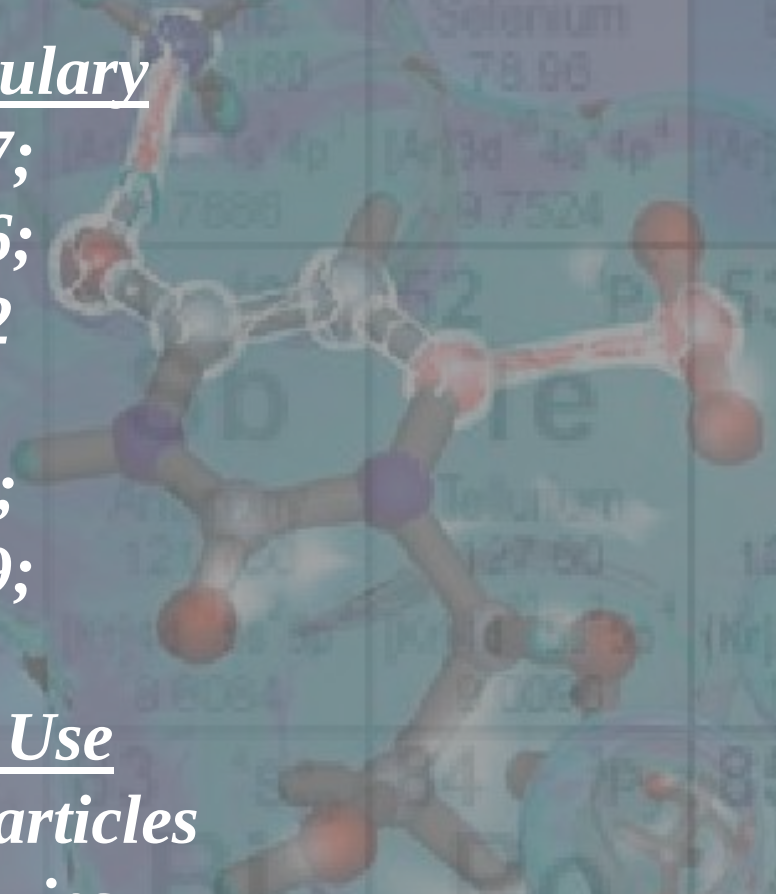
ELECTROLYTIC CELLS

Fill in the gaps with corresponding words from the box below (ex. 10, p. 54).

An ionic …….. is dissolved with an appropriate……, or otherwise melted by heat, so that its ……..are available in the liquid. An electrical current is applied between a pair of inert …….immersed in the liquid. The negatively charged electrode is called the……, and the positively charged one the…….. Each electrode attracts ions which are of the opposite……. Therefore, positively charged ions (called……..) move towards the cathode, while negatively charged ions (termed……) move toward the anode. The energy required to separate the ions, and cause them to gather at the respective electrodes, is provided by an electrical power supply. At the probes, ……. are absorbed or released by the ions, forming a collection of the desired element or compound.

anode	**ions**	**electrodes**	**cations**	**electrons**
anions	**cathode**	**compound**	**solvent**	**charge**

TASK FOR SELF STUDY



Active Vocabulary

- ✓ *ex. 2, p. 57;*
- ✓ *ex. 2, p. 66;*
- ✓ *ex. 2, p. 82*

Reading

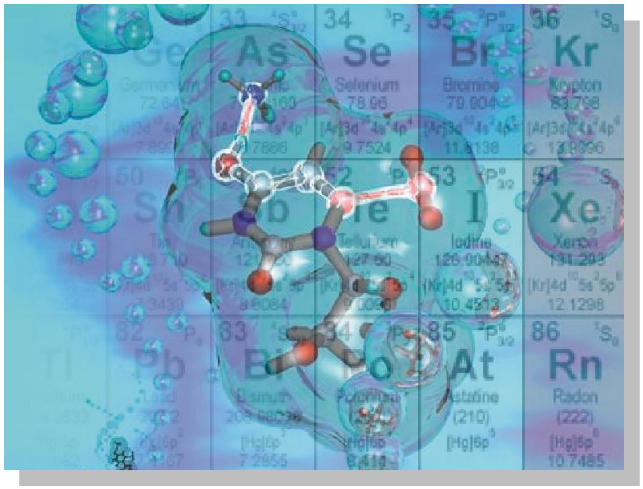
- ✓ *ex. 5, p.58;*
- ✓ *ex. 6, p. 59;*
- ✓ *ex. 7, p.84*

Professional Use

- ✓ *Scientific articles*
- ✓ *U-tube movies*

Associate professor, PHD,
OSTVALD ROMAN

BASICS OF ANALYTICAL CHEMISTRY



Electrochemical Cells