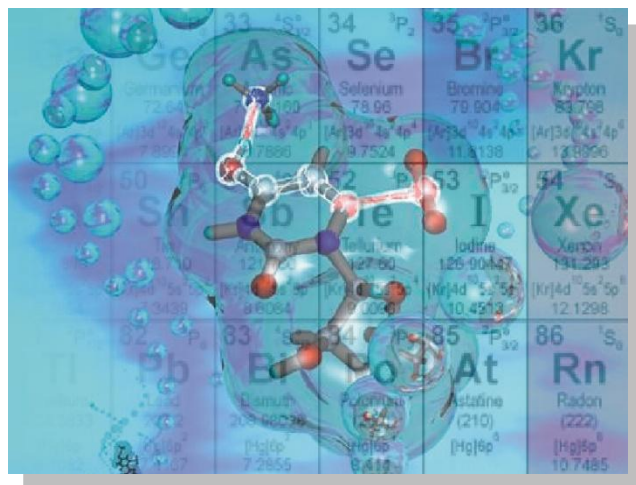


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BASICS OF ANALYTICAL CHEMISTRY



Subject of Analytical
Chemistry

SUBJECT OF ANALYTICAL CHEMISTRY

quality

numerical quantity of electrostatic charge assigned to a molecule atom

technique

number, amount, specified or considerable amount

reducing agent

an acceptor of electrons

a donor of electrons

oxidizing agent

the process of decreasing the oxidation number

reduction

attribute, characteristic, property, degree of excellence

oxidation number

method of performance

to forbid to do smth officially

quantity

SUBJECT OF ANALYTICAL CHEMISTRY

interaction

instance

*process of the transfer from
reducing agent to oxidizing agent*

branch

do business with

*contact, relations, co-operation
between particles*

oxidation

*the process of increasing
the oxidation number*

REDOX reaction

*example; particular case;
v - to illustrate, to exemplify*

deal with

subdivision, section

SUBJECT OF ANALYTICAL CHEMISTRY

Ex. 4, p.6 – text “Analytical Objectives or What Analytical Chemists Do”

1	<i>relating to scientific tests used to help with laws</i>	_____	
2	<i>that can produce good crops</i>	_____	
3	<i>that makes smth impure</i>	_____	
4	<i>the red liquid flowing through the bodies of humans</i>	_____	
5	<i>a person accused in a legal cast</i>	_____	
6	<i>quality of being effective</i>	_____	

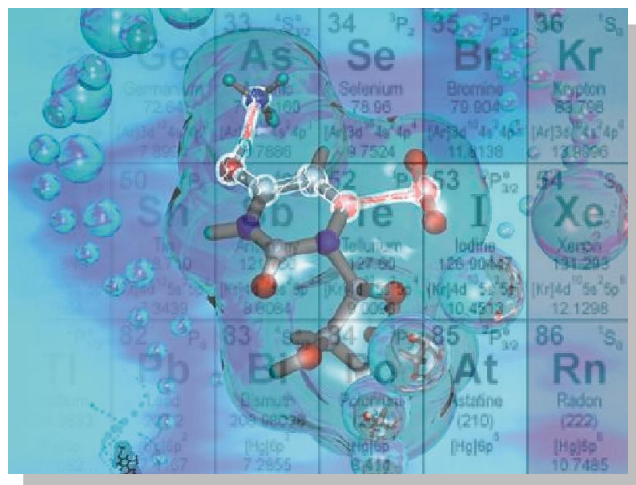
SUBJECT OF ANALYTICAL CHEMISTRY

Ex. 7, p.8 – text “Qualitative and Quantitative Analysis”

Title	Number of paragraph	Right variant
<i>the identification of elements</i>		
<i>simple qualitative tests</i>		
<i>the fast-screening phase</i>		
<i>the identification phase</i>		
<i>possible quantification</i>		

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BASICS OF ANALYTICAL CHEMISTRY



Chemical Methods of
Analysis

CHEMICAL METHODS OF ANALYSIS

Confidence

*Defectiveness,
incompleteness*

Completion, entirety

Cluster

*Increase,
expansion*

Imperfection

Small

*Assurance,
certainty*

Growth

Factor

Coefficient

Set fire

Igniting

Negligible

*Encourage,
give incentive*

Promote

Completeness

Bunch

CHEMICAL METHODS OF ANALYSIS

Ex. 5, p.17

Choose a suitable phrase in column "B" to accompany phrases in column "A" and translate the sentences into Russian



Choose a suitable phrase in column "B" to accompany phrases in column "A" and translate the sentences into Russian.

A

B

1. A gravimetric precipitate ...
2. The substance being analyzed ...
3. This contamination ...
4. Since the analyte is almost always weighed in a form different from the precipitated form, ...

- a) the precipitate formed should be easy and completely converted into the weighed form.
- b) should be negligible.
- c) should be precipitated completely.
- d) should be a compound of the known chemical composition.

GRAVIMETRIC ANALYSIS

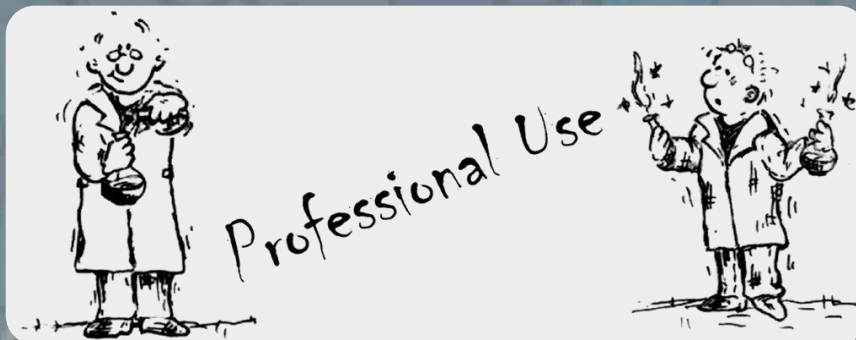
*Look the text
“Gravimetric Analysis”*

(ex. 3, p. 15) and try to answer on next questions

“Oral Practice”

- ✓ *What is gravimetric analysis?*
- ✓ *What reactions can be used in gravimetric analysis?*
- ✓ *What steps are needed to complete a gravimetric analysis?*
- ✓ *What is the gravimetric factor?*

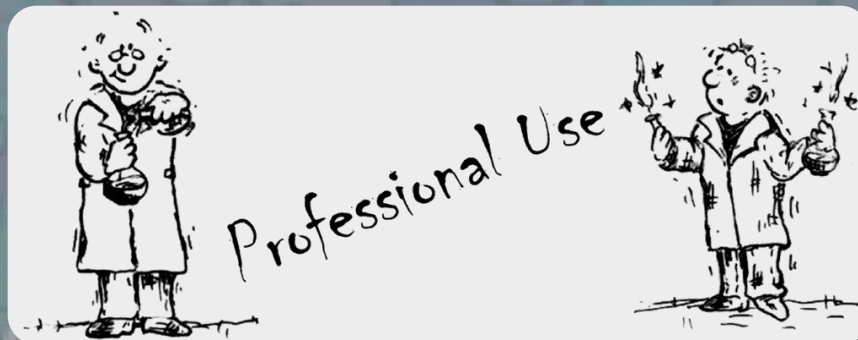
GRAVIMETRIC ANALYSIS



Full the table represented below

Element sought	Precipitating reagent	Chemical reaction	Precipitate weighed
Ba ²⁺	SO ₄ ²⁻	$\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4\downarrow + 2\text{NaCl}$	BaSO ₄
		$\text{Fe}_2(\text{SO}_4)_3 + 6\text{NaOH} \rightarrow 2\text{Fe}(\text{OH})_3 + 3\text{Na}_2\text{SO}_4$	
		$\text{Th}(\text{NO}_3)_4 + 2(\text{NH}_4)_2\text{C}_2\text{O}_4 \rightarrow \text{Th}(\text{C}_2\text{O}_4)_2\downarrow + 4\text{NH}_4\text{NO}_3$	
		$\text{AgNO}_3 + \text{HCl} \rightarrow \text{AgCl}\downarrow + \text{HNO}_3$	
		$\text{NiCl}_2 + 2\text{HC}_4\text{H}_7\text{O}_2\text{N}_2 \rightarrow \text{Ni}(\text{C}_4\text{H}_7\text{O}_2\text{N}_2)_2\downarrow + 2\text{HCl}$	
		$3\text{FeCl}_2 + 6\text{NH}_4\text{OH} \rightarrow 3\text{Fe}(\text{OH})_3\downarrow + 6\text{NH}_4\text{Cl}$ $2\text{Fe}(\text{OH})_3 \rightarrow \text{Fe}_2\text{O}_3 + 3\text{H}_2\text{O}$	

GRAVIMETRIC ANALYSIS



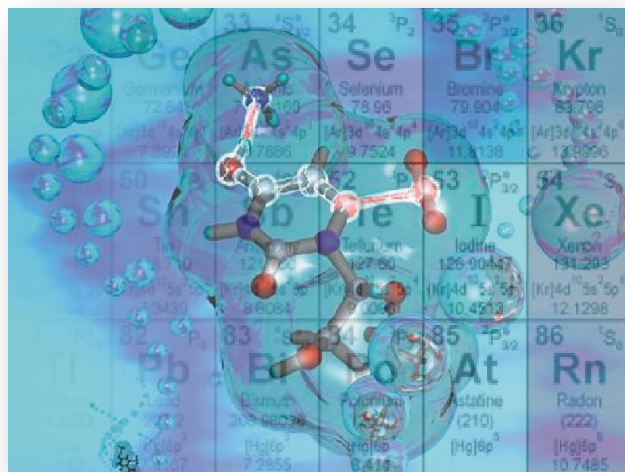
Make up gravimetric factors for the following substances

Substance sought	Substance weight	Gravimetric Factor
ZrO ₂	ZrOCl ₂ ·8H ₂ O	
Th	Th ₂ O ₇	
U	U ₃ O ₈	
U ₃ O ₈	UO ₂ (NO ₃) ₂	
U ₃ O ₈	(NH ₄) ₄ UO ₂ (CO ₃) ₃	
Ce	Ce(NO ₃) ₃ ·2NH ₄ NO ₃ ·4H ₂ O	
Li ₂ O	LiAl[Si ₂ O ₆]	
SO ₃	Na ₃ [Pd(S ₂ O ₃) ₂]	

Calculate the mass of the substances sought given in the table (the 1-st column), provided the total mass of the substances (the 2-nd column) is equal to 100 g.

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BASICS OF ANALYTICAL CHEMISTRY



Introduction into
Theoretical
Electrochemistry.
REDOX Theory

REDOX THEORY

reference, n

know again, notice

*the electrode where
oxidation occurs*

salt bridge

*forms of compounds
with hydrogen*

*a connection between
two solutions*

recognize, v

*small capacity
in electro chemistry*

*hydro-,
prefix*

cell, n

*recommendation,
orientation*

*the electrode where
reduction occurs*

give off, v

attract, v

*draw, approach, magnetize,
create a center of attention*

anode

cathode

hand over

REDOX THEORY

*Look the shot movie
“REDOX reactions”*

‘عزیز’ *Oral Practice* ‘عزیز’

<http://www.youtube.com/watch?v=yp60-oVxrT4>

and discuss next questions

- ✓ *What does the term “REDOX” mean?*
- ✓ *What are general indicators of the REDOX reaction?*
- ✓ *What is “oxidation number”?*
- ✓ *Could you explain terms oxidation and reduction process?*
- ✓ *What is called oxidant and reductant? Give your own example?*
- ✓ *Could you find an example when in oxidation and reduction process transfer of electrons don't occur?*

REDOX THEORY

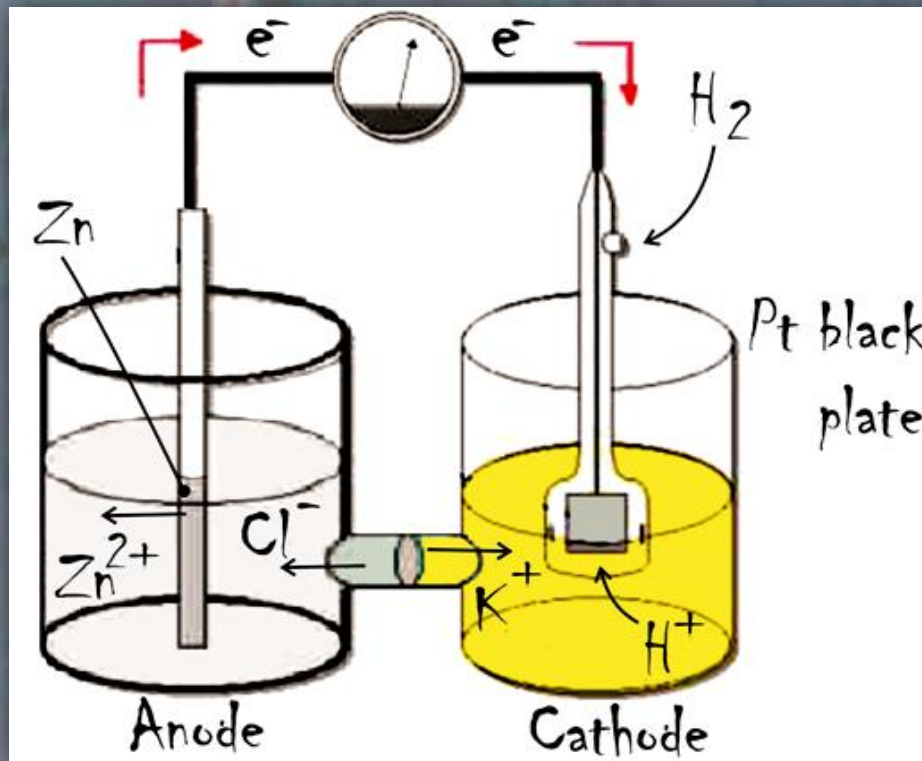
Read the text “REDOX Theory” (ex. 5, p. 25) and try to discuss the following questions again.



- ✓ *What does the term “REDOX” mean?*
- ✓ *What are general indicators of the REDOX reaction?*
- ✓ *What is “oxidation number”?*
- ✓ *Could you explain terms oxidation and reduction process?*
- ✓ *What is called oxidant and reductant? Give your own example?*
- ✓ *Could you find an example when in oxidation and reduction process transfer of electrons don't occur?*

REDOX THEORY

Look at the picture and explain in what half-cell the process of oxidation and process of reduction occur. Write half-reactions



Reduction half-reaction _____

Oxidation half-reaction _____

REDOX THEORY

Point out the oxidant and reductant in the following chemical reactions

- $UF_4 + F_2 \rightarrow UF_6;$
- $Zn + 2HCl \rightarrow ZnCl_2 + H_2;$
- $BeCl_2 + Mg \rightarrow MgCl_2 + Be;$
- $C + O_2 \rightarrow CO_2;$
- $2UF_5 \rightarrow UF_4 + UF_6;$
- $Br_2 + 3F_2 \rightarrow 2BrF_3;$
- $CuI_2 \rightarrow Cu + I_2$

REDOX THEORY

Write semi-reactions of the oxidation and reduction processes for the following reactions

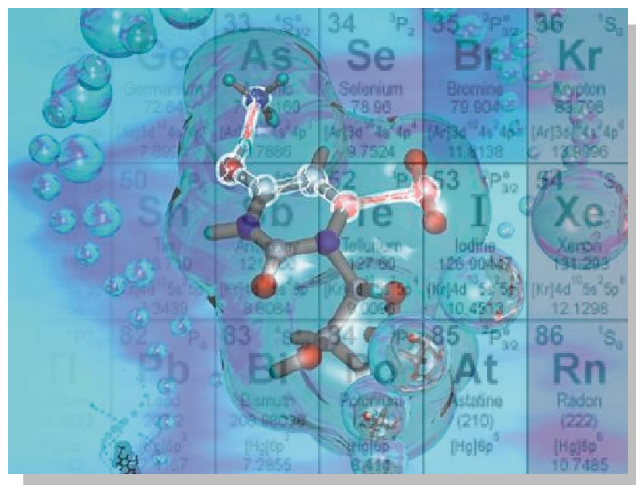
- $BeSO_4 + 4NaOH \rightarrow Na_2BeO_2 \downarrow + Na_2SO_4 + 2H_2O;$
- $BeO + C + Cl_2 \xrightarrow{900-1000^\circ C} BeCl_2 + CO;$
- $8HI + H_2SO_4 \rightarrow 4I_2 + H_2S + 4H_2O;$
- $KNO_3 + Al + KOH + H_2O \rightarrow NH_3 + KAlO_2;$
- $NH_3 + O_2 \xrightarrow{750^\circ C} NO + H_2O;$
- $5U(SO_4)_2 + 2KMnO_4 + 2H_2O \rightarrow 5UO_2SO_4 + K_2SO_4 + 2MnSO_4 + 2H_2SO_4$
- $2N(2O^+)^5 + 5KMnO^4 + 5H^5O \rightarrow 2NO^52O^4 + K^52O^4 + 5Mn^52O^4 + 5H^52O^4$

Reduction half-reaction _____

Oxidation half-reaction _____

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BASICS OF ANALYTICAL CHEMISTRY



Electrochemical Cells
Galvanic Cells

GALVANIC CELLS

anion, n
['ænaɪən]

practical unit of quantity in measuring electricity

galvanism, n

not bound by rules

joule, n

electro-negative ion

cation, n
['kætaɪən],

*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”*

‘ع’ ‘ر’ ‘ي’ ‘ا’ ‘ل’ ‘م’ ‘ن’ ‘ي’ ‘ا’ ‘ل’ ‘م’ ‘ن’
Oral Practice

*<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

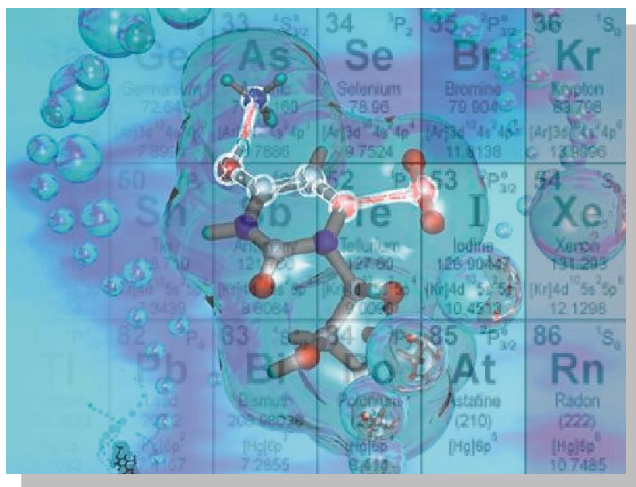
*Read information in ex. 10, p. 35
and carry out the following task*

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

Ti/Ti²⁺//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	

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BASICS OF ANALYTICAL CHEMISTRY



Electrochemical Cells
Electrolytic Cells

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

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

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:

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

TASK FOR SELF STUDY

Active Vocabulary

- ✓ *ex. 2, p. 23;*
- ✓ *ex. 2, p. 32;*
- ✓ *ex. 2, p. 57*

Reading

- ✓ *ex. 3, p.50;*
- ✓ *ex. 5, p. 51;*
- ✓ *ex. 9, p.53*

Professional Use

- ✓ *Scientific articles*
- ✓ *Presentations of James K. Hardy*
- ✓ *U-tube movies*

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BASICS OF ANALYTICAL CHEMISTRY

