



## PA 7.5.1 SYLLABUS

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Approved

At the meeting of the Council of Faculty of Pharmacy  
Minutes No. 4 of 12.06.2014

Dean of the Faculty of Pharmacy,  
PhD, associate professor N. Ciobanu



Approved

At the meeting of the chair of General Chemistry  
Minutes No. 11 of 06.06.2014

Head of the chair, C. Cheptănu  
PhD, associate professor C. Cheptănu

### SYLLABUS FOR STUDENTS OF FACULTY OF PHARMACY

Name of the course: **General and Inorganic Chemistry**

Code of the course: **F01O004; F02O016**

Type of course: **compulsory**

**Total number of hours – 153**

**lectures - 68 hours, practical lessons - 85 hours**

Number of credits provided for the course: **9**

Lecturers teaching the course: **PhD, associate professor – Chistruga Loghin**

**PhD, associate professor – Negreata Nelly**

**Chisinau 2014**



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### *I. Aim of the discipline:*

The discipline General and Inorganic Chemistry aims a broad research area, systematizing not only the general material from the chemistry and physics, but also it brings out new principles that consist the base of methods with a large theoretical and practical application area.

The main goal of this course is to study those branches of chemistry that form the theoretical bases for the deeper and more complete understanding of physical and colloidal chemistry, pharmaceutical chemistry, which are going to give a full training to specialist in pharmacy.

### *II. Objectives obtained in teaching the discipline:*

#### ▪ At the level of knowledge and understanding

- to understand the goals and objectives of general and inorganic chemistry, ways and methods of their accomplishments ;
- to understand the main role and importance of general and inorganic chemistry methods in pharmacy, the scientist's practical activity in the pharmaceutical field;
- to know the main chapters, notions and methods of general and inorganic chemistry;
- to know connection properties between inorganic compounds and the place of elements in the periodic system;
- to calculate the energetic parameters for chemical processes, to determine their direction, conducting degree and their calculation methods of chemical equilibrium;
- to know the bases of inorganic theory compounds structure and theory of chemical binding;
- to know main properties of chemical elements and their compounds;
- to know main types of inorganic compounds and their contemporary nomenclature (including complex compounds).

#### ▪ At the level of application

- To work independently with the literature in the field of general and inorganic chemistry.
- To apply the principles processes and the technique of achieving the experimental work at the general and inorganic chemistry.
- To use at the laboratory class the main inorganic reagents, solvents and chemical dishes.
- To use properly the nomenclature of inorganic compounds.
- To calculate the main energetic parameters in order to study various chemical processes.
- To prepare solutions with the concentration of dissolved substances.



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- To predict the possible spontaneous course of processes of the shifts of chemical equilibrium.
  - At the level of integration
- To estimate the significance of general and inorganic chemistry at the level of integration through pharmacy chains (pharmacology, pharmaceutical chemistry, toxicological chemistry, technology of medical products, etc).
- To know the chemical actions of different medical inorganic compounds in the human body.
- To study the most important chemical elements as well as their compounds, that are most used in the pharmaceutical field.
- To know the presence of chemical elements, especially bio-elements in the constitution of living matters, the way that this connects to the protein components, to establish their functions and behaviors in bioinorganic chemistry, also to take and to use for human benefits from what nature offers to us.

### ***III. Provisional terms and conditions:***

Combining theoretical and practical studies, the primary goal of general and inorganic chemistry is to give out a full training that improves the productive forces, acceleration of the technical progress in medicine, industry, agriculture, etc.

Inorganic chemistry deals with the studying of those well-known 100 elements, with their compounds properties, structures and their transformations.

According to the analytical program that is oriented to the actual pedagogical principles, the material is presented in two parts:

1<sup>st</sup> part-deals with theoretical bases of chemistry and refers to the main notions of the physical chemistry necessary to study inorganic chemistry.

2<sup>nd</sup> part –deals with the studying of elements and their compounds. Both the elements with nonmetallic properties followed by the elements with semi –metallic properties and the elements with metallic properties are studied.

In order to succeed in studying this subject you need deep knowledge in the field of physics.

### ***IV. Main theme of the course:***

General and Inorganic Chemistry is a 2-semester credit class that introduces the major aspects of chemistry.

#### ***A. Lectures:***

	<i>Themes</i>	Hours
1	The theory of atomic structure. Quantum mechanical model of atom. The	2



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	characteristic of energy states of electrons in atoms.	
2	The electronic structure of atoms and the periodic table of elements.	2
3	Chemical bond. Valence bonding method.	2
4	Chemical bond. Molecular orbital method.	2
5	Chemical thermodynamics. Thermo chemistry. Entropy. Free energy Gibbs.	2
6	Chemical equilibrium. The law of mass action reported to chemical equilibrium Le Chatelier Braun principle.	2
7	Kinetic chemistry. Nations of speed and reaction. The basic postulate of kinetic chemistry. The dependence of reaction speed upon temperature.	2
8	Oxidation-reduction reactions. Classification Methods of equalization. Environment influence over the direction of oxidation-reduction reactions display.	2
9	Studies about solutions. Methods of expressing the concentration of solutions. Colligative properties of the solutions.	1
10	Equilibrium in weak electrolytes. Ostwald's dilution law.	2
11	Basic thesis of solutions theories of hard electrolytes. Ionic product of water. The exponent of Hydrogen and Hydroxyl.	2
12	The theory of acids and bases : Arrenius, protolytic and Lewis-Pearson's	2
13	Acids and basics strength. Acidity and basicity constants.	2
14	Hydrolysis. Constants of hydrolysis and the grade of hydrolysis, relation between them.	2
15	Combinations of coordination. Coordinative theory and complex combination of Werner. Classification and nomenclature complex combination.	2
16	Nature of chemical bands in complex combinations. Equilibrium in complex combination solutions.	2
17	Chelates and inside complex combinations. Isomerism complex combination.	2
18	S-elements. Hydrogen, general characteristic. S-elements of the I.A group. Alkaline metals, properties of its compounds.	2
19	S-elements of the II.A group. General characteristic salts of alkaline earth metals. The biological role of the I.A and II.A group elements.	2
20	d-Elements, general characteristics . d-Elements of the III.B –IV.B groups, d- Elements of the VI.B group .Chromium, Chromium (II), (III) and (IV). The basic-acid and oxidation –reduction properties of this compounds. The capacity to form the complexes.	2
21	d-Elements of the VII.B group , general characteristics. Manganese , Manganese (II), (IV), (VI) and (VII). The basic acid and oxidation-reduction properties of its compounds. The biological role of manganese.	2
22	d-Elements of the VIII.B group, general characteristics. Iran compounds (II) and Iran compounds (III). The basic acid and oxidation-reduction properties of its	2



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	compounds. Iron (VI). Irons, obtaining method and oxidation properties. Cobalt and nickel. Co(II), Co(III) and Ni(II) compounds, its properties. Cobalt compounds in medicine. General characteristics platinum metals.	
23	d-Elements of the I.B group. General characteristics of the group. Copper (I) and copper (II), the basic acid and oxidation-reduction characteristics, the capacity to form the complexes. Silver compounds, the basic acid and oxidation-reduction characteristics. Gold. Gold compounds (I) and Gold (III), the B-A and O-R characteristic. The biological role of copper. Silver and gold compounds in medicine.	2
24	d-Elements of the II.B group, general characteristics. Zinc. The B-A and O-R characteristic of Zinc compounds. Complex combination of Zinc. Cadmium and its compounds. Mercury. Mercury compounds (I) and mercury (II), its B-A and O-R characteristic. Zinc and mercury compounds in medicine.	2
25	p-Elements general characteristics. p-Elements of the III.A group. Boron and Aluminum and its compounds, B-A and O-R characteristic. The biological role of boron. Aluminum compounds in medicine.	2
26	P-Elements of the IV.A group, general characteristic. Carbon. Oxide (II), B-A and O-R characteristic. Carbon (IV) compounds. Carbonic acid, carbonates and hydrogen carbonates. Silicon. Silicides. Compounds with hydrogen (silanes), oxidizes and hydrolysis. Silicon oxide(IV). Silicic acid. Silicates. The biological role of carbon and silicon.	2
27	d-Elements of Germanium subgroup, general characteristic. Oxide and hydroxide, its amphoteric properties. Tin and lead, its salts. O-R reactions in solutions. Lead compounds in medicine.	
28	P-Elements of the V.A group, general characteristic. Nitrogen. Nitrogen compounds with its negative degree of oxidation, its B-A and O-R characteristic. Nitrogen compounds with its positive degree of oxidation, its B-A and O-R properties. Application in medicine ammonia, oxide nitrogen (1), nitrites Na and K.	
29	P-Elements of the V.A group. Phosphorous compounds with positive degree of oxidation. Hydro phosphorous and phosphorous acids. Phosphorous acid. Metaphosphoric acid. Phosphorous in living organism.	
30	p-Elements of the V.A group. Arsenic subgroup, general characteristic, Compounds with hydrogen. Determination of arsenic Marsh's method. Compounds with halogens. Oxide and hydroxide, its B-A and O-R properties. Arsenite and arsenate. Antimony. Antimony oxides and acid. Bismuth. Stibic acid and its salts. Importance arsenic, antimony and bismuth compounds in medicine.	
31	p-Elements of the VI.A group, its general characteristic. Sulfur, chemical activity. Sulfur compounds of its negative degrees of oxidation. Sulfur compounds (IV) oxide. Thionyl chloride. Sulfurous acid, sulfites and hydrogenosulfites. Sulfur compounds (VI), the B-A and O-R properties. Piro-sulfuric acid. Peroxymonosulfuric and peroxydisulfuric acids. Tiosulfate. Polytione acids. The biological role of sulfur, its compounds in medicine.	



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32	p-Elements of the VII.A group , general characteristic . Chemical activity of halogens. Halogens compounds with hydrogen. Halogenides. Inter halogens compounds. The interactions with water and bases.	
33	p-Elements of the VII.A group. Chlorine oxide, its B-A and O-R properties. Oxygenated acids of Chlorine and its salts, O-R properties . Depending on the degree of oxidation of halogen. The biological importance of halogens, its compounds in medicine.	
34	Biogenic elements. Micro-and macro- biogenic elements.	

### B. Practical lessons:

	<i>Themes</i>	Hours
1	Regulations on work in chemical laboratory	2
2	Atomic structure. Characteristics of energy states of electrons in atoms	2
3	The electronic configuration of atoms.	2
4	Covalent bonds and its properties.	2
5	Energy diagram of molecular orbitals (OM).	2
6	Determination of dilute and neutralization enthalpy.	2
7	Factors Affecting Chemical Equilibrium.	2
8	The dependence of decomposed reactions speed $\text{Na}_2\text{S}_2\text{O}_3$ upon its concentration and temperature.	2
9	Final lesson 1: Atomic structure and chemical bond. Chemical thermodynamics and kinetic chemistry.	2
10	Oxidation-reduction reactions in neutral, acid and base environments.	2
11	Oxidation-reactions $\text{H}_2\text{O}_2$ in different environments.	2
12	Preparing solutions.	2
13	Properties of solutions. Osmotic pressure sugar solution.	2
14	Determination solutions in force. Measuring pH water solutions.	2
15	Solution hydrolysis.	2
16	Final lesson 2: Solutions and its properties. Oxidation-reduction reactions.	2
17	Final lesson: colloquium.	2
18	Combinations of coordination. Classification, nomenclature and isomerism.	3
19	Hydrogen, its preparation and properties. Properties $\text{H}_2\text{O}_2$ .	3
20	Properties of alkaline and alkaline earth metals.	3
21	Study properties Cr(II), Cr(III) and Cr(VI) compounds.	3
22	Chemical properties of manganese compounds.	3
23	Chemical properties of iron, cobalt and nickel compounds.	3



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24	Chemical properties of copper and silver compounds.	3
25	Chemical properties of zinc, cadmium and mercury compounds.	3
26	Final lesson 3: s-and d-Elements	3
27	Study properties aluminum and boron compounds.	3
28	Chemical properties of IV.A group elements. Carbon, Silicon, tin and lead . Its compounds	3
29	Chemical properties of nitrogen and phosphorous compounds.	3
30	Chemical properties of arsenic subgroup elements. Antimony . Bismuth.	3
31	Chemical properties sulfur and its compounds.	3
32	Study properties chlorine, bromine and iodine compounds.	3
33	Final lesson 4:p-Elements of III.A-III.A groups.	3
34	Final lesson and admission to examination	3

### ***V. Recommended literature:***

#### ***A. Compulsory:***

1. Curs de chimie. T.Conunov, M.Popov,I.Fusu. Chi in u,1994.
2. Lucr ri practice de chimia anorganic . A.Gulea ,I.Sandu, M.Popov. Chi in u 1994.
3. Chimie generala. Indicații metodice pentru lucr rile practice i de laborator (pentru studenții facult ții de farmacie). L. Chistruga. CEP “Medicin ” , Chi in u, 2011.
4. ( ), “Medicin ” , Chi in u, 2011.
5. Chimie anorganic . Indicații metodice pentru lucr rile practice i de laborator (pentru studentii facult ții de farmacie), CEP “Medicin ” , Chi in u , 2006.
6. ( , “Medicin ” , Chi in u, 2006.

#### ***B. Additional:***

1. , 1984.
2. , 1988.
3. , 1982.

### ***VI. Teaching and learning methods:***

The discipline General and Inorganic Chemistry is taught in a classical manner, which includes theoretical lectures and practical lessons. During the lecture the information of the



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course is presented. At practical classes students study the most necessary and significant laws of chemistry:

- Chemical thermodynamics
- Chemical equilibrium
- Chemical kinetics
- Solution and their properties
- Complex compounds
- The atomic structure and chemical bond

The second part deals with principles of descriptive inorganic chemistry. The most important chemical elements, as well as their compounds which are most used in the pharmaceutical practice are studied here.

### ***VII. Suggestions for individual activity:***

If you want to succeed in learning General and Inorganic Chemistry, you need to work actively with the material. What does it mean?

1. At first, read the new information very thoroughly, not simply looking through it. Make some notes in your workbook. Try to formulate by yourself the main ideas, using your own words. Study the schemes and pictures from the book and textbook. Answer the questions from the textbook. Remember and write all formulas of chemical compounds and chemical reaction equations.

2. Attend all lectures and practical works, but not just to be present! If you are doing that it's hardly to say that you will meet the requirements. Pay attention and think at what you sum up.

3. Ask questions to improve your learning. When you prepare for the class make up specific questions to ask your teacher, students, even yourself. This may happen in the assembly hall, in the hall and in the teacher's office. Doing so will help you increase your participation and encourage your active learning. The mere fact of question asking means that you try to figure out and understand the themes properly, which is greatly welcomed. We also have tutorials where you are welcome whenever you need it.

4. Join into small groups of 2-3 students each in order to meet regularly and discuss different lectures and laboratory classes material which means that you will get prepared for the seminars and final test-papers. Small group work allows students to test their thinking, to explore issues together, to understand and to acquire the information much better. It encourages deep learning and higher-order activities- analysis, evaluation and synthesis, which could be much more useful than individual work.

5. Use your time wisely. The General and Inorganic Chemistry discipline has high requirements. More other disciplines taught this year, also have the same requirements. According to the established rules, students are supposed to work one hour directly with the instructor and 2-3 hours independently. In other words, for an efficient learning of the course, you need to work individually at least 5 hours per week.





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### ***VIII. Methods of assessment:***

At the General and Inorganic Chemistry during the year of study, there are tests (formative assessments) in the following order:

- Test No 1: Atomic Structure and Chemical Bonding. Power Engineering and Chemical Reaction.

#### Kinetics

- Test No2: Oxidation Reduction reactions. Solutions and their properties. Complex Compounds.
- Test No3: s and d block elements.
- Test No4: p block elements.

Thus, the final test-papers are held in written form and have the following structure: 5 tests on General and Inorganic Chemistry, where 3 of them are test items and the other 2 are theoretical questions and problems. Each test is graded from 0 to 5. The tests have different variants. Each variant has 20 questions and the students have 20 minutes to do the whole test. The evaluation is carried out according to the concurrent system criteria (the variant "Test Editor" USMF "Nicolae Testimiteanu").

The students with the average mark less than 5,0 as well as those who haven't recovered the absences from the laboratory works are not admitted to final exam on General and Inorganic Chemistry.

There are two stages of the exam on General and Inorganic Chemistry: testing (the variant "Test Editor" USMF "Nicolae Testimiteanu") and oral answer.

The examination questions (the test items and the list of theoretical questions) are approved at the chair meeting and are announced to students at least one month before the examination session.

The final grade is made up of three components: the average grade for the year (coefficient 0.5), oral examination (coefficient 0.3), testing (coefficient 0.2)



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### Methods of mark rounding

The average of current and final marks	Final mark
5	5
5,1-5,5	5,5
5,6-6,0	6
6,1-6,5	6,5
6,6-7,0	7
7,1-7,5	7,5
7,6-8,0	8
8,1-8,5	8,5
8,6-9,0	9
9,1-9,5	9,5
9,6-10	10

*Absence on examination without good reason is recorded as "absent" and is equivalent to 0 (zero). The student has the right to re-take the exam twice.*

### ***IX. Language of study:***

Romanian, Russian, English