

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	ANORGANSKA KEMIJA
<b>Course Title:</b>	INORGANIC CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja, UŠP Biokemija, 1. stopnja, UŠP Kemija, 1. stopnja	/	1.	2.
USP Chemical Engineering, 1 <sup>st</sup> Cycle, USP Biochemistry, 1 <sup>st</sup> Cycle, USP Chemistry, 1 <sup>st</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:** obvezni / Mandatory

**Univerzitetna koda predmeta / University Course Code:** KE108

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	30	/	/	/	75	5

**Nosilec predmeta / Lecturer:** prof. dr. Anton Meden / Dr. Anton Meden, Full Professor

**Jeziki / Languages:** Predavanja / Lectures: slovenski / Slovenian  
Vaje / Tutorial: slovenski / Slovenian

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

**Prerequisites:**

The course has to be assigned to the student.

**Vsebina:**

**Periodni sistem** kot osnova sistematike elementov in anorganskih spojin.  
**Vodik in kisik.** Voda. Vodikov peroksid. Protolitske reakcije oksidnega peroksidnega in superoksidnega iona. Nomenklatura.  
**Elementi 17. skupine.** Spojine elementov 17. skupine z vodikom. Spojine s kisikom, oksokislina in oksosoli. Medhalogenske spojine. Reakcije disproporcionacije in vpliv sinteznih pogojev na kemijsko ravnotežje pri pripravi oksospojin halogenov. Nomenklatura.  
**Elementi 16. skupine.** Spojine elementov 16.

**Content (Syllabus outline):**

**Periodic table** as a basis of the systematic of elements and inorganic compounds.  
**Hydrogen, Oxygen,** Water, Hydrogen peroxide. Protolytic reactions of oxide, peroxide and superoxide ion, Nomenclature.  
**Elements of Group 17.** Compounds of Group 17 elements with hydrogen. Compounds with oxygen, oxo-acids and oxo-salts. Interhalogen compounds. Disproportionation reactions and the influence of synthesis conditions on the preparations of oxo-compounds of halogens. Nomenclature.

skupine z vodikom. Protoliza sulfidnih ionov. Oksidi in oksospojine žvepla, selena in telurja. Primeri homogene in heterogene katalize pri sintezi žveplove kisline. Spojine s halogeni. Nomenklatura.

**Elementi 15. skupine.** Spojine elementov 15. skupine z vodikom. Sinteza amoniaka: vpliv reakcijskih pogojev in katalizatorja na ravnotežje in hitrost reakcije. Oksidi in oksospojine. Spojine elementov V. skupine s halogeni in žveplom. Nomenklatura.

**Elementi 14. skupine.** Spojine elementov 14. skupine z vodikom. Oksidi, oksospojine in soli. Boudouardovo ravnotežje. Halogenidi in sulfidi elementov 14. skupine. Ogljikov dioksid v vodni raztopini: kombinacija molekularne in protolitske reakcije. Silikati. Nomenklatura.

**Elementi 13. skupine.** Bor in spojine bora. Razlaga strukture boranov z uporabo kombinacije teorije VV in MO. Aluminij in spojine aluminija. Pregled lastnosti spojin galija, indija in talija. Nomenklatura.

**Elementi 1. in 2. skupine.** Lastnosti zemeljskoalkalijskih kovin in njihovih spojin. Lastnosti alkalijskih kovin in njihovih spojin. Nomenklatura.

**Elementi 18. skupine.** Spojine žlahtnih plinov in njihove lastnosti.

**Pregled kemije prehodnih elementov.** d-orbitale in njihova vloga v kemiji prehodnih elementov. Pregled lastnosti prve vrste kovin prehoda. Pregled lastnosti druge in tretje vrste kovin prehoda. Lantanoidi in aktinoidi. Jedrske reakcije. Pregled elementov in njihovih spojin po skupinah. Oksidi, hidroksidi in oksokisljine prehodnih elementov. Koordinacijske spojine in njihova uporaba.

**Elements of Group 16.** Compounds of Group 16 elements with hydrogen. Protolysis of sulfide ions. Oxides and oxo-compounds of sulfur, selenium and tellurium. Examples of homogeneous and heterogeneous catalysis at the synthesis of sulfuric acid. Compounds with halogens. Nomenclature.

**Elements of Group 15.** Compounds of Group 15 elements with hydrogen. Synthesis of ammonia: the influence of reaction conditions and catalyst on the equilibrium and velocity of reaction. Oxides and oxo-compounds. Compounds of group 15 elements with halogens and sulfur. Nomenclature.

**Elements of Group 14.** Compounds of Group 14 elements with hydrogen. Oxides oxo-compounds and salts. Influence of reaction conditions on the equilibrium of CO and CO<sub>2</sub>. Halogenides and sulfides of the Group 14 elements. Carbonic acid in aqueous solution: combination of protolytic and molecular compounds. Silicates. Nomenclature.

**Elements of Group 13.** Boron and boron compounds. Explanation of the structures of boranes applying a combination of VB and MO theories. Aluminum and aluminum compounds. Survey of the properties of gallium, indium and thallium compounds. Nomenclature.

**Elements of Groups 1 and 2.** Properties of earth-alkali metals and their compounds. Properties of alkali metals and their compounds. Nomenclature.

**Elements of Group 18.** Compounds of noble gases and their properties.

**Survey of the chemistry of transition elements.** d-orbitals and their role in the transition elements chemistry. Survey of the properties of the first row of transition elements. Survey of the properties of the second and third row of transition elements. Lanthanoids and actinoids. Nuclear reactions. Survey of the groups of transition elements. Oxides, hydroxides and oxo-acids of the transition elements. Coordination compounds and their application.

## Temeljna literatura in viri / Readings:

### Osnovni učbenik:

- Boris Čeh, Anorganska kemija, Založba UL FKKT, Ljubljana 2019, 351 str.

### Dodatna literatura:

- C. E. Housecroft, A. G. Sharpe, Inorganic Chemistry, Pearson, Prentice Hall, 2<sup>nd</sup>, 2005; (<http://files.rushim.ru/books/neorganika/housecroft.pdf>) (40%)

## Cilji in kompetence:

**Cilji:** Študenti usvojijo temeljno in celotno znanje anorganske kemije, poznavanje določenih anorganskih spojin, njihovih lastnosti in reaktivnosti. Pri tem študent na specifičnih primerih utrjuje in pogloblja znanje splošnih kemijskih zakonitosti.

**Kompetence:** Študent bo pridobljeno znanje znal uporabiti pri nadaljnjem študiju in v praksi, znal se bo pogovarjati o kemijskih problemih s področja, ki ga obravnava predmet; znal bo povezati znanje splošne in anorganske kemije za reševanje, razlago ali analizo določenega problema. Poznal bo strukturne značilnosti in reaktivnost anorganskih spojin, značilne in pomembne kemijske reakcije anorganskih spojin ter nomenklaturu anorganskih spojin

## Objectives and Competences:

**Objectives:** students acquire basic and complete knowledge of inorganic chemistry, knowledge of given inorganic compounds, their properties and reactivity. Along with this, the student confirms and deepens the knowledge of general chemical principles.

**Competences:** student will be able to apply the acquired knowledge at further study and in practice, he will be able to discuss chemical problems in the field of the subject and will be able to integrate the knowledge of general and inorganic chemistry to solve, explain or analyze a given problem. He will know the structural characteristics and reactivity of inorganic compounds and the nomenclature thereof.

## Predvideni študijski rezultati:

### Znanje in razumevanje

Študent pozna osnovne značilnosti kemije elementov glavnih skupin in prehodnih elementov v periodnem sistemu ter pozna in razume osnovne kemijske zakonitosti, ki vplivajo na periodične lastnosti elementov in njihovih spojin (strukturne značilnosti, reaktivnost anorganskih spojin, značilne in pomembne kemijske reakcije anorganskih spojin ter nomenklaturu anorganskih spojin).

### Uporaba

Pridobljeno znanje in razumevanje so potrebna osnovna znanja, ki jih študent uporablja za razlago eksperimentalno določenih ali drugače pridobljenih podatkov,

## Intended Learning Outcomes:

### Knowledge and Comprehension

Student knows basic chemical characteristics of the main group elements and transition elements in the periodic system. He knows and understands the basic chemical principles that influence the periodic properties of the elements and their compounds (structural properties, reactivity of inorganic compounds, characteristic and important chemical reactions of the inorganic compounds and nomenclature of the inorganic compounds).

### Application

Acquired knowledge and understanding are the necessary basis that is applied for explanation of experimental or otherwise acquired data, connected to the chemistry of the main group

povezanih s kemijo elementov glavnih skupin in prehodnih elementov periodnega sistema in je osnova za nadaljnji študij kemije. Prav tako je to znanje temeljno pri opravljanju poklica	elements and the transition elements of the periodic system, which is the basis of the further study of chemistry. This knowledge is as well fundamental for the professional activity.
<b>Refleksija</b> Študent je sposoben oceniti pomen osnovnih kemijskih zakonitosti in teoretskega znanja za razlago eksperimentalnih dejstev in lastnosti anorganskih snovi in jih zna uporabiti v praksi.	<b>Analysis</b> Student is able to assess the meaning of basic chemical principles and theoretical knowledge for an explanation of experimental facts and properties of compounds and is able to use them in practice.
<b>Prenosljive spretnosti</b> Študent zna poiskati podatke iz strokovne literature, podatke iz virov medmrežja pa zna kritično oceniti. Zna uporabljati strokovni jezik (pisno in ustno).	<b>Skill-transference Ability</b> Student is able to find data from professional literature and is able to critically evaluate the data from the internet; he is able to use the professional language (written and spoken).

#### Metode poučevanja in učenja:

Predavanja; sodelovalno učenje/ poučevanje ter problemsko delo na seminarjih. Sprotno preverjanje znanja s testi.

#### Learning and Teaching Methods:

Lectures; cooperative learning/teaching and problem work at seminars; regular knowledge assessment using tests.

#### Načini ocenjevanja:

2 testa za sprotno preverjanje znanja in pisni izpit. Če študent na vsakem od obeh testov najmanj 51 % točk je lahko oproščen opravljanja izpita.

Ocenjevalna lestvica v skladu z enotno lestvico na Univerzi v Ljubljani:  
6 – 10 opravil izpit,  
1 – 5 ni opravil izpita.

Delež (v %) /  
Weight (in %)

#### Assessment:

2 test for during the semester and written exam. If the student collects at least 51 % of points at each of the tests, he can be excused from the exam.

Grades according to the standard levels of the University of Ljubljana:  
6-10 passed,  
1-5 insufficient.

#### Reference nosilca / Lecturer's references:

- MALI, Gregor, MEDEN, Anton, DOMINKO, Robert. [sup] 6 Li MAS NMR spectroscopy and first-principles calculations as a combined tool for the investigation of Li [sub] 2 MnSiO [sub] 4 polymorphs. *Chemical communications*, ISSN 1359-7345, 2010, issue 19, str.3306-8, doi: [10.1039/c003065a](https://doi.org/10.1039/c003065a). [COBISS.SI-ID [4386074](https://www.cobiss.si/id/4386074)]
- KÜZMA, Mirjana, DOMINKO, Robert, HANŽEL, Darko, KODRE, Alojz, ARČON, Iztok, MEDEN, Anton, GABERŠČEK, Miran. Detailed in situ investigation of the electrochemical processes in Li[sub]2FeTiO[sub]4 cathodes. *Journal of the Electrochemical Society*, ISSN 0013-4651, 2009, vol. 156, no. 10, str. A809-A816. [COBISS.SI-ID [4219162](https://www.cobiss.si/id/4219162)]
- MOLČANOV, Krešimir, KOJIĆ-PRODIĆ, Biserka, MEDEN, Anton. [pi]-Stacking of quinoid rings in crystals of alkali diaqua hydrogen chloranilates. *CrystEngComm*, ISSN 1466-8033, 2009, vol. 11, iss. 7, str. 1407-1415, doi: [10.1039/b821011j](https://doi.org/10.1039/b821011j). [COBISS.SI-ID [516331545](https://www.cobiss.si/id/516331545)]