

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	PRAKTIKUM IZ SPLOŠNE IN ANORGANSKE KEMIJE
Course Title:	LABORATORY PRACTICE IN GENERAL AND INORGANIC CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemija, 1. stopnja	/	1.	1. in 2.
USP Chemistry, 1 st Cycle	/	1 st	1 st and 2 nd

Vrsta predmeta / Course Type:

obvezni / Mandatory

Univerzitetna koda predmeta / University Course Code:

KE104S

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	/	60 SV + 90 LV	/	/	150	10

Nosilec predmeta / Lecturer:

prof. dr. Franc Perdih / Dr. Franc Perdih, 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:

Na seminarjih se z računskimi vajami utrjuje znanje kemijskega računanja, potrebnega za izvedbo posameznih laboratorijskih vaj in se sproti preverja znanje študentov pred posamezno praktično vajo. Ob vseh laboratorijskih vajah se vsebina osnovnega kemijskega računanja smiselno nadgrajuje: osnovni kemijski zakoni, množina snovi, molska masa snovi, formule spojin, računanje povezano s kemijsko reakcijo, parcialni tlaki, množinski deleži (molski ulomki), prostorninski deleži, povprečne molske mase, koncentracije raztopin ter računanje pri titracijah, topnosti snovi, kemijsko ravnotežje, protolitska ravnotežja in redoks reakcije. V laboratoriju se študenti

Content (Syllabus outline):

The knowledge on chemical calculations is refreshed during seminars. This knowledge is required to perform individual laboratory practice, and is tested before each practical laboratory session. The content of basic chemical calculations is built upon: basic chemical principles, mole concept, molar mass, chemical formula, calculations connected with chemical reaction, partial pressure, mole fraction, volume fraction, average molar mass, solution concentration and titration calculation, solubility of substances, chemical equilibrium, ionization and redox reactions. At the beginning of the course, students are introduced to safety rules. Then they individually perform 22 laboratory practices (11 in each semester),

najprej seznanijo z varnostnimi pravili dela. Nato samostojno izvedejo 22 praktičnih vaj (11 v vsakem semestru), ob katerih se naučijo osnovne veščine praktičnega laboratorijskega dela kot so npr: izparevanje, filtracija, sušenje, sinteza spojin, merjenje prostornine plinov in tekočin, priprava raztopin, merjenje gostote tekočin, itd. Z uporabo kemijskega računanja znajo kvantitativno ovrednotiti svoje meritve pri praktičnih vajah, na podlagi opazovanj pri kvalitativnih poskusih znajo povezati praktične izkušnje z osnovnimi kemijskimi zakonitostmi.

Vsebine praktičnih vaj: Formule kemijskih spojin. Masna in množinska razmerja snovi. Kemijska reakcija, prebitek reaktantov, izkoristek kemijski reakciji. Plini. Povprečna molska masa plinske zmesi. Priprava raztopin iz trdnih topljencev. Mešanje raztopin. Reakcije med raztopinami kislin in baz. Topnost snovi. Prekristalizacija. Sinteza $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. Kemijsko ravnotežje. Določevanje ravnotežne konstante K_c . Protolitska ravnotežja v vodnih raztopinah. Protolitska ravnotežja v raztopinah soli. Določanje mase amonijevega klorida v raztopini. Ionske reakcije. Topnostni produkt. Amfoterne snovi. Redoks reakcije. Koordinacijske spojine. Sinteza CuI . Sinteza in karakterizacija $\text{K}_2[\text{Cu}(\text{C}_2\text{O}_4)_2] \cdot 2\text{H}_2\text{O}$.

where they learn basic skills of practical laboratory work such as evaporation, filtration, drying, synthesis of compounds, volume measurement of gases and solutions, solution preparation, measurement of solution density, etc. With the help of the acquired knowledge of chemical calculation, they are able to evaluate the measurements obtained during practices. They are able to link practical experience, obtained during observations of qualitative experiments, with basic chemical laws.

Content of laboratory experiments: Formulae of chemical compounds. Molar and mass ratios. Chemical reaction, limiting reactant, yield of chemical reaction. Gases. Average molar mass of gas mixtures. Preparation of solutions from solid solutes. Mixing of solutions. Reactions between acids and bases. Solubility. Recrystallization. Synthesis of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. Chemical equilibrium. Determination of equilibrium constant K_c . Ionization in water solutions. Ionization in salt solutions. Determination of ammonium chloride mass dissolved in solution. Ionic reactions. Solubility product. Amphoteric substances. Redox reactions. Coordination compounds. Synthesis of CuI . Synthesis and characterization of $\text{K}_2[\text{Cu}(\text{C}_2\text{O}_4)_2] \cdot 2\text{H}_2\text{O}$.

Temeljna literatura in viri / Readings:

- N. Bukovec, R. Cerc Korošec, E. Tratar Pirc: Praktikum iz splošne in anorganske kemije, Založba UL FKKT, Ljubljana, 2010 (druga dopolnjena izdaja), 113 str.

- N. Bukovec, R. Cerc Korošec, A. Golobič, N. Lah in E. Tratar Pirc: Osnove kemijskega računanja, zbirka nalog, Založba UL FKKT, Ljubljana, 2011, 191 str.

Cilji in kompetence:

Cilji: Znati in uporabljati osnovno kemijsko računanje ter osnovne kemijske zakonitosti. Obvladati principe varnega dela v laboratoriju, različne metode dela, oziroma pristope pri praktičnem delu v laboratoriju.

Kompetence: Znajo varno ravnati z kemikalijami, poznajo varnostne zahteve in ukrepe v laboratoriju; spoznajo in obvladajo različne osnovne metode laboratorijskega dela; znajo samostojno izvajati posamezne

Objectives and Competences:

Objectives: The student is familiar with and knows how to apply basic chemical calculations and fundamental laws of chemistry. They also master the principles of safe laboratory practice, different methods and approaches to practical laboratory work.

Competences: Working safely and autonomously in a laboratory. Ability to use different methods of basic laboratory work. Ability to apply knowledge of basic chemical

eksperimente; so sposobni kritično ovrednotiti določene meritve in/ ali dobljene rezultate pri kemijskem računanju.

calculations in solving practical problems in the laboratory. Ability to critically evaluate measurements and the results obtained from chemical calculations.

Predvideni študijski rezultati:

Znanje in razumevanje

Študent osvoji osnovno praktično znanje varnega dela v kemijskem laboratoriju ter zna osnove kemijskega računanja uporabiti pri kvantitativnem vrednotenju določenih eksperimentov.

Uporaba

Pridobljena znanja oziroma spretnosti pri laboratorijskem delu, znanje postopkov in pristopov pri reševanju nalog pri kemijskem računanju so temelji predmetom pri nadaljnjem študiju.

Refleksija

Študent je sposoben kritično ovrednotiti izvedene meritve in oceniti dobljene rezultate pri tem pa razvija sposobnosti za samostojno laboratorijsko delo. Teoretične naloge zna povezati z eksperimentalnimi meritvami in se tako nauči povezovanja teorije in prakse.

Prenosljive spretnosti

Študent pridobi praktične laboratorijske spretnosti in izkušnje, znanje kemijskega računanja ter zna uporabljati strokovni jezik (pisno in ustno).

Intended Learning Outcomes:

Knowledge and Comprehension

Knowledge of the basic principles of safety at work and different methods of work in a laboratory. Application of basic chemical calculations in solving practical problems.

Application

Knowledge and skills gained through laboratory practice, and the knowledge of procedures and approaches used to solve chemical calculation problems provide a foundation for further studies.

Analysis

The student can critically evaluate measurements and results while developing the skills required for independent laboratory work. They understand the link between theoretical exercises and experimental measurements and thus learn to connect theory and practice.

Skill-transference Ability

The student gains practical laboratory skills and experience, a knowledge of chemical calculation, and can use correct terminology in both written and spoken form.

Metode poučevanja in učenja:

Sodelovalno učenje / poučevanje ter problemsko delo na seminarjih. Sprotno preverjanje znanja na vsakem seminarju (pisno). Pisni pregledni kolokviji ob zaključku določene vsebinske teme predmeta. Laboratorijske vaje, zasnovane na individualnem delu študenta ter delno s timskim delom. Pisanje laboratorijskega dnevnika.

Learning and Teaching Methods:

Collaborative learning/teaching and problem solving at seminars. Short written evaluation of the students' knowledge before every laboratory practice. Comprehensive written midterm exams at the end of each topic. Laboratory practice based on the students' individual work and group work. Laboratory journal.

Načini ocenjevanja:

Delež (v %) /

Weight (in %) **Assessment:**

<p>- pisni izpit (nadomestijo ga lahko trije pozitivno ocenjeni kolokviji) - uspešno opravljena pisna preverjanja pred vsako vajo (vstopni testi) - opravljene vaje so pogoj za pristop k izpitu Ocene: pozitivno 6–10; negativno 1–5</p>		<p>- written examination (can be replaced by three positively evaluated midterm exams) - positive grades in pre-lab tests - completed laboratory practice is prerequisite for the examination Grades: 6–10 pass, 5 fail</p>
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Reference nosilca / Lecturer's references:

1. D. Sanna, J. Palomba, G. Lubinu, P. Buglyó, S. Nagy, F. Perdih, E. Garribba: Role of ligands in the uptake and reduction of V(V) complexes in red blood cells. *J. Med. Chem.* 2019, 62, 654–664.
2. T. Koleša Dobravec, K. Maejima, Y. Yoshikawa, A. Meden, H. Yasui, F. Perdih: Bis(picolinato) complexes of vanadium and zinc as potential antidiabetic agents: synthesis, structural elucidation and in vitro insulin-mimetic activity study. *New J. Chem.* 2018, 42, 3619–3632.
3. T. Koleša Dobravec, E. Lodyga-Chruscinska, M. Symonowicz, D. Sanna, A. Meden, F. Perdih, E. Garribba: Synthesis and characterization of VIVO complexes of picolinate and pyrazine derivatives. Behavior in the solid state and aqueous solution and biotransformation in the presence of blood plasma proteins. *Inorg. Chem.* 2014, 53, 7960–7976.
4. F. Perdih: Benzoylacetate and its fluorinated derivatives as ligands for Co(II) complexes : the effect of the presence of fluorine atoms on the crystal packing. *Struct. Chem.* 2014, 25, 809–819.