

## UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	EKSPERIMENTI IZ SPLOŠNE IN ANORGANSKE KEMIJE V ŠOLI
<b>Course Title:</b>	SCHOOL EXPERIMENTS IN GENERAL AND INORGANIC CHEMISTRY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
MAG Kemijsko izobraževanje, 2. stopnja	/	1.	2.
USP Chemical Education, 2 <sup>nd</sup> Cycle	/	1 <sup>st</sup>	2 <sup>nd</sup>

**Vrsta predmeta / Course Type:**

obvezni / Mandatory

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

IZO212

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
10	5	60 LV	/	/	75	5

**Nosilec predmeta /  
Lecturer:**

izr. prof. dr. Romana Cerc Korošec /  
Dr. Romana Cerc Korošec, Assoc. Prof.

**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:**

### PREDAVANJA

- Varnostni in zaščitni ukrepi pri eksperimentiranju.- Namen demonstracijskih poskusov učitelja: predstavitev eksperimenta, izvedba in vključitev eksperimenta v določeno vsebino pouka na različnih nivojih.
- Izdelava delovnega lista za izvedbo poskusov ter praktična navodila za učitelja in učenca.
- Možnosti uporabe raziskovalnega pristopa pri nekaterih vsebinah iz splošne in anorganske kemije v povezavi z demonstracijskim poskusom učitelja ali v okviru eksperimentalnih vaj dijakov/učencev.
- Fotografiranje in filmsko snemanje

**Content (Syllabus outline):**

### LECTURES:

- Safety and protection measures during demonstration experiments.
- The purpose of the demonstration experiments of the teacher: presentation of the experiment, implementation and inclusion of the experiment in certain contents of the lesson at various levels.
- Preparation of a worksheet for carrying out experiments and practical instructions for the teacher and pupil.
- Possibilities of using a research approach in some general and inorganic chemistry content in connection with a teacher demonstration

posameznih eksperimentov, uporaba računalniški programov in multimedijskih orodij za predstavitev eksperimentov.

- Trendi vključevanja eksperimentov v pouk kemije v svetu.
- Trendi v razvoju anorganske kemije ter možnost vključevanja določenih aktualnih vsebin v pouk v srednji šoli.

#### PRAKTIČNE VAJE

- Študent v dogovoru z učiteljem izbere pet eksperimentov iz različnih poglavij Splošne in anorganske kemije, ki jih samostojno pripravi in jih nato prikaže pred kolegi in učiteljem. Učitelj skupno s študenti kritično analizira demonstracijo in razlago posameznih eksperimentov s poudarkom na ugotovitvi, ali je eksperiment ustrezno prikazal želene vsebine na izbranem nivoju poučevanja. Vedno se oceni varno delo pri eksperimentiranju.
- Učitelj vsakemu študentu določi temo. Študent pregleda nekaj učbenikov za osnovne in srednje šole, veljavne učne načrte za osnovne in srednje šole, tudi medmrežje ter na izbrano tematiko pripravi pet eksperimentov. Študent mora pripravljene eksperimente oddati v pisni obliki iz za dva pripraviti delovnilista za izvedbo poskusov ter praktična navodila za učitelja in učenca.

#### TEME POSKUSOV:

- 1.) Množina snovi (tehtanje mola določene snovi, določitev formule hidratizirane soli, določitev Avogadrove konstante).
- 2.) Kemijske enačbe (določitev koeficientov kemijske enačbe, presežek pri kemijski reakciji).
- 3.) Gradniki snovi (prepoznavanje ionske, kovalentne, molekulske in kovinske zgradbe; ugotavljanje polarnosti tekočin; vpliv vodikove vezi na viskoznost tekočine).
- 4.) Fizikalne in kemijske lastnosti plinov (plinski zakoni, vpliv molske mase na hitrost plinskih molekul, priprava in

experiment or within experimental exercises of pupils.

- Documenting of individual experiments with photography and film, use of computer programs and multimedia tools for presentation of experiments.
- Trends of integration of experiments in chemistry lessons in the world.
- Trends in the development of inorganic chemistry and the possibility of incorporating certain topical contents into secondary school lessons.

#### PRACTICAL EXERCISES

- The student chooses five experiments from different chapters of General and Inorganic Chemistry in agreement with the teacher, which he prepares independently and presents them to classmates and the teacher. The teacher and other students then critically analyze the demonstration and explanation of individual experiment with an emphasis on the adequacy of the performed experiment and the desired content at the selected level of teaching. The safety during experimenting is always evaluated.
- The teacher determines a topic for each student. The student then examines various textbooks for elementary and secondary schools, internet sources and the valid curricula for elementary and secondary schools and prepares five experiments on the selected topic. The student must submit the prepared experiments in writing form. For two of them the student has to prepare worksheets and practical instructions for the teacher and the pupil.

#### TOPICS OF EXPERIMENTS

- 1.) Mole concept (weighing of a mole of a certain substance, determination of the formula of a hydrate salt, determination of the Avogadro constant)
- 2.) Chemical equations (determination of chemical equation coefficients, limiting reagent)
- 3.) Fundamental units of matter (identification of ionic, covalent, molecular and metal

lastnosti CO<sub>2</sub>, priprava in lastnosti vodika, amoniaka, klora).

- 5.) Nastanek in lastnosti raztopin (entalpija raztapljanja, zvišanje vrelišča, znižanje zmrzišča, osmoza, koloidne raztopine).
- 6.) Redoks reakcije (prikaz različnih redoks reakcij).
- 7.) Koordinacijske spojine (vpliv ligandov na barvo in stabilnost koordinacijske spojine).
- 8.) Značilnosti elementov (fizikalne in kemijske lastnosti elementov 3. periode).
- 9.) Kovine I., II. in III. skupine (nekaterne reakcije Na, Mg in Al).
- 10.) Prehodni elementi (oksidacijska stanja V in Mn, redoks reakcije Cu).

structures, determination of polarity of liquids, influence of hydrogen bonds on the viscosity of a liquid)

- 4.) Physical and chemical properties of gases (gas laws, the influence of molar mass on the velocity of gas molecules, preparation and properties of CO<sub>2</sub>, preparation and properties of hydrogen, ammonia, chlorine)
- 5.) Formation and properties of solutions (enthalpy of solution, boiling-point elevation, freezing-point depression, osmosis, colloidal solutions)
- 6.) Redox reactions (presentation of different redox reactions)
- 7.) Coordination compounds (the influence of ligands on color and stability of the coordination compound)
- 8.) Characteristics of elements (physical and chemical properties of elements of the 3rd period)
- 9.) Metals of the I., II. and III. groups (some Na, Mg and Al reactions)
- 10.) Transition elements (oxidation states of V and Mn, redox reaction of Cu)

#### Temeljna literatura in viri / Readings:

1. F. Lazarini, Eksperimenti za pouk splošne in anorganske kemije – zbirka eksperimentov za predavalne poskuse, Katedra za anorgansko kemijo, Ljubljana, 1992, 61 str.
2. N. Bukovec, J. Brenčič: Kemija za gimnazije 1, DZS, 2001, 160 str.
3. N. Bukovec, D. Dolenc, B. Šket: Kemija za gimnazije 2, DZS, Ljubljana, 2002, str 7-88.
4. A. Laincbury, J. Stephens, A. Thompson, M. Graunar: Praktična kemija, Priročnik za učitelje in laborante, DZS, Ljubljana, 2002.
5. Advanced Practical Chemistry, urednika A. Thompson in L. Atteshlis, John Murray Publishers LTD, London, 1994.
6. B. Z. Shakhshiri: Chemical Demonstrations, Volume 1, 2, 3; Th University of Winsconsin Press, Madison, 1985.
7. L.R. Summerlin, J.B. Ealy Jr.: Chemical Demonstrations, Volume 1 (Second Edition), American Chemical Society, Washington DC, 1988
8. L.R. Summerlin, C. L. Borgfold, J.B. Ealy: Chemical Demonstrations, Volume 2 (Second Edition), American Chemical Society, Washington DC, 1988.

#### Cilji in kompetence:

**Cilji:** Cilji predmeta so, da se študenti/ke naučijo, kako vključiti ustrezne kemijske

#### Objectives and Competences:

**Objectives:** The objectives of the course are to teach students how to include appropriate

eksperimente pri obravnavi splošne in anorganske kemije v srednji šoli; da bodo znali zbrati vse podatke in ustrezno varno pripraviti kemijski eksperiment; da bodo znali uporabljati enostavne multimedijske pripomočke za obravnavo eksperimentov; da bodo znali kritično ocenili posamezne demonstracijske eksperimente in znali pripraviti učni list ter navodila za učence.

**Kompetence:** študent bo temeljito seznanjen z varnostnimi predpisi dela v laboratoriju; študent bo varno rokoval s kemikalijami in laboratorijsko opremo;; sposoben bo poiskati ustrezne literaturne podatke; znal bo samostojno izvesti in razložiti kemijske poskuse ter predstaviti rezultate; po analizi bo znal odpraviti morebitne napake; znal bo eksperimente predstaviti tudi na medmrežju.

chemical experiments in the discussion of general and inorganic chemistry in secondary school; that they will be able to collect all the data and prepare a chemical experiment accordingly; that they will be able to use simple multimedia devices to handle experiments; that they will be able to critically evaluate performed demonstration experiments and be able to prepare a worksheet and instruction for pupils.

**Competences:**  
The student will be thoroughly familiar with the safety regulations of laboratory work; the student will safely handle chemicals and laboratory equipment; will be able to find relevant literature data; will be able to independently carry out and explain chemical experiments and present the results; after analysis he will be able to correct potential errors; he will also be able to present experiments on the internet.

**Predvideni študijski rezultati:**

Znanje in razumevanje  
Študent bo znal izbrati in predstaviti kemijske eksperimente in jih ustrezno vključiti pri pouku kemije.

Uporaba  
Pridobljene spretnosti pri praktičnem delu so osnova za delo študenta kot učitelja v kemijskem laboratoriju.

Refleksija  
Študent bo znal kritično ovrednotiti vrednost posameznega eksperimenta. Seveda bo poudarek na varnem eksperimentiranju.

Prenosljive spretnosti  
Študent pridobi dodatne praktične izkušnje pri delu v laboratoriju, zna pripraviti učno enoto, zna predstaviti tudi eksperimentalno delo na medmrežju s kratkimi filmskimi posnetki.

**Intended Learning Outcomes:**

Knowledge and Comprehension  
The student will be able to choose and present chemical experiments and appropriately include them in chemistry lessons.

Application  
Acquired skills in practical work are the basis for the work of a student as a teacher in a chemical laboratory.

Analysis  
The student will be able to critically evaluate the value of each experiment. Emphasis will be given on safe experimentation.

Skill-transference Ability  
experience in working in the laboratory, can prepare a teaching unit and can also present experimental work on the Internet using short film recordings.

**Metode poučevanja in učenja:**

Predavanja predstavijo bistvena teoretična ozadja, ki so nujna za razumevanje izbranih eksperimentov. S seminarji dodatno poglobimo razumevanje in študentom

**Learning and Teaching Methods:**

Lectures present essential theoretical backgrounds that are necessary for understanding the experiments. During the seminars, we further deepen the understanding

pomagamo izbrati primerne eksperimente. Glavni del predmeta so eksperimentalne laboratorijske vaje in priprava poročil oz. predstavitev. Delo študentov je kombinacija individualnega in timskega. Praktično delo v laboratoriju poteka samostojno ob pomoči učitelja in laboranta. Eksperimente predstavijo študentje svojim kolegom in učitelju.

and help students to select appropriate experiments. The main part of the subject are experimental laboratory exercises and the preparation of reports and presentations. The work of students is a combination of individual and teamwork. Practical work in the laboratory is carried out independently with the help of a teacher and a laboratory assistant. Students present experiments to their colleagues and teacher.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
<ul style="list-style-type: none"> <li>- sposobnost študenta za samostojno delo med potekom predmeta</li> <li>- kvaliteta pisnega izdelka</li> <li>- kvaliteta predstavitve na koncu projekta</li> </ul> <p>Ocene v okviru ECTS ocenjevanja na UL (pozitivna ocena je 6 ali višje).</p>	<p>10 %</p> <p>40 %</p> <p>50 %</p>	<ul style="list-style-type: none"> <li>- the ability of the student for independent work during the course</li> <li>- quality of written reports</li> <li>- quality of the presentation at the end of the class</li> </ul> <p>Grades according to ECTS grading at UL (positive grade is 6 and higher).</p>

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

- 1.) Bukovec Nataša, **Cerc Korošec Romana**, Tratar Pirc Elizabeta: *Praktikum iz splošne in anorganske kemije*, 2. dopolnjena izd., Ljubljana, Fakulteta za kemijo in kemijsko tehnologijo, 2010. 114 str.
- 2.) Bukovec Nataša, **Cerc Korošec Romana**, Golobič Amalija, Lah Nina, Tratar Pirc Elizabeta: *Osnove kemijskega računanja: zbirka nalog*, 1. izd., Ljubljana, Fakulteta za kemijo in kemijsko tehnologijo, 2011. 192 str.
- 3.) P. Galer, **R. Cerc Korošec**, M. Vidmar, B. Šket: Crystal Structures and Emission Properties of the BF<sub>2</sub>-Complex 1-Phenyl-3-(3,5-dimethoxyphenyl)-propane-1,3-dione: Multiple Chromisms, Aggregation- or Crystallization-Induced Emission and the Self-Assembly Effect. *Journal of the American Ceramic Society*, 2014, 136, 7383-7394.
- 4.) B. Genorio, K. Pirnat, **R. Cerc Korošec**, R. Dominko, M. Gaberšček: Electroactive organic molecules immobilized onto solid nanoparticles as a cathode material for lithium-ion batteries. *Angewandte Chemie*, 2010, 9, 7222-7224.
- 5.) **Cerc Korošec Romana**, Bukovec Peter: Sol-gel prepared NiO thin films for electrochromic applications, *Acta chim. slov.*, 2006, vol. 53, no. 2, str. 136-147.