

# Chemistry of Elements

## CHEM-E4130 (5 cr)

**Lectures (14 x):** Monday (Ke4) 12.15 – 14.00  
Wednesday (Ke2) 10.15 – 12.00  
Friday (Ke4) 10.15 – 12.00

**Lecturers:** Maarit Karppinen  
Antti Karttunen (one lecture)  
Linda Sederholm (one lecture)

- Lectures: 15 x 2 h
- Home problem solving 30 h
- Independent homework 60 h
- Exam 3 h

### MARKING

- **Exam:** 50 points
- **Lecture exercises:** 25 points  
14 x 2 p → 28; 3 extra points possible!
- **Seminar:** 25 points

The course covers the basics of the chemistry of elements.

**Emphasis on the d-block transition metals and lanthanides.**

After the course the student will be able to:

1. Explain the basic features of the transition metal chemistry
2. Derive the basic chemical and physical properties of d-block and f-block transition metals from their electron structures
3. Describe different types of metal complexes and metal-organics
4. Describe the most important compounds of transition elements and name their applications
5. Find and read basic scientific literature on a given topic related to the chemistry of elements

**Positive Overlapp:**  
**CHEM-E4101 Lab. Course**  
by Eeva Rautama

### REFERENCE BOOKS

- Descriptive Inorganic Chemistry, G. Rayner-Canham & T. Overton, W.H. Freeman and Company.
- Chemistry of the Elements, N.N. Greenwood & A. Earnshaw, Pergamon Press.
- Inorganic Chemistry, C.E. Housecroft & A.G. Sharpe, Pearson.

## **INSTRUCTIONS for LECTURE EXERCISES**

- These are simple questions/small exercises meant to help you to follow the lecture/test your learning
- The questions/exercises are given to you in MyCourses at the same time as the lecture slides
- You should be able to easily answer to the questions during the lecture or just after the lecture; this should typically not take more than 15 ~ 20 min
- Then the deadline for returning your answer file is next day by the noon.
- Each exercise is evaluated in the scale: 0 ~ 2 points
- All together you can collect  $14 \times 2 = 28$  points in maximum

## INSTRUCTIONS for SEMINAR PRESENTATIONS

- Presentation (~20 min) is given in a group of three persons
- It is evaluated in the scale: 15 ~ 25 points
- Presentation is given in English, and the slides are put up in MyCourses afterwards
- Content of the presentation:
  - **ELEMENT:** discovery, origin of name, abundancy, world production, special features if any, etc.
  - **CHEMISTRY:** position in Periodic Table, electronic configuration, oxidation states, metal and ionic sizes, reactivity, etc.
  - **COMPOUNDS:** examples of important compounds, their properties and applications, etc.
  - **SPECIFIC FUNCTIONALITIES/APPLICATIONS:** Two or three examples of exciting functionalities/applications of the element or its compounds. Here the meaning is to discuss why this specific element is needed in each selected application. You will be given one scientific article for a reference, and you should search for couple of more (recent) articles to be discussed in the presentation.

# TENTATIVE LECTURE SCHEDULE

Mon (Ke4) 12.15 – 14.00  
Wed (Ke2) 10.15 – 12.00  
Fri (Ke4) 10.15 – 12.00

	Date	Topic
1.	Wed 07.09.	Course Introduction & Short Review of the Elements
2.	Fri 09.09.	Periodic Properties & Periodic Table & Main Group Elements (starts)
3.	Mon 12.09.	Short Survey of the Chemistry of Main Group Elements (continues)
4.	Fri 16.09.	Zn + Ti, Zr, Hf & Atomic Layer Deposition (ALD)
5.	Mon 19.09.	Transition Metals: General Aspects & Pigments
6.	Wed 21.09.	Redox Chemistry
7.	Fri 23.09.	Crystal Field Theory (Linda Sederholm)
8.	Mon 26.09.	V, Nb, Ta & Metal Complexes & MOFs
9.	Wed 28.09.	Cr, Mo, W & 2D materials
10.	Fri 30.09.	Mn, Fe, Co, Ni, Cu & Magnetism & Superconductivity
10.	Mon 03.10.	Ag, Au, Pt, Pd & Catalysis (Antti Karttunen)
11.	Fri 07.10.	Lanthanoids + Actinoids & Luminescence
12.	Mon 10.10.	EXTRA
14.	Wed 12.10.	Resources of Elements & Rare/Critical Elements & Element Substitutions
15.	Fri 14.10.	Inorganic Materials Chemistry Research

**EXAM: Oct. 18, 9:00-12:00**

# PRESENTATION TOPICS/SCHEDULE

**Fri 16.09. Ti:**  
**Zn:**

**Mon 26.09. Nb:**

**Wed 28.09. Mo:**

**Fri 30.09. Mn:**  
**Cu:**  
**Ru:**

**Fri 07.10. Eu:**  
**Nd:**  
**U:**

**Wed 12.10. Co:**  
**In:**  
**Te:**