UNIWERSYTET GDAŃSKI

Course title
Chemia koordynacyjna / Coordinative chemistry

ECTS code
13.3.0407

Name of unit administrating study
Faculty of Chemistry

Studies

Field of study	Type	Form	
Chemistry	Masters	Full-time studies	

Teaching staff
dr hab. Dagmara Jacewicz, prof. UG

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
lecture

B. The realization of activities
in-class learning

C. Number of hours
30 h lecture

ECTS credits 3

classes - 30 h
tutorial classes – 10 h
student's own work – 35 h

Total: 75 h - 3 ECTS

The academic cycle
2019/20 summer semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods

Effective multimedia lecture slides

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
lecture – exam

B. Assessment methods
Written exam with open questions

C. The basic criteria for evaluation or exam requirements
About 15 open questions
91 % - 100 % - 5,0
81 % - 90 % - 4,5
71 % - 80 % - 4,0
61 % - 70 % - 3,5
51 % - 60 % - 3,0
50 % and less - 2,0

Required courses and introductory requirements
Inorganic chemistry

Aims of education

Systematic nomenclature of coordination chemistry.
Application of known theories to explain problems of stereochemistry, spectroscopic properties and magnetic coordination compounds.
Introduction to the subject matter related to the interpretation of the electronic absorption spectra of the coordination compounds of d-block metals based on the parameters of Slater-Condon-Shortley and Racah.
Application of the molecular orbital theory to the description of bonds in complexes.

Course contents

Introduction to Coordination Chemistry**:** survey of coordination numbers; stereochemistry, ligand types; *dn* configurations; elementary bonding theories; structure determination; nomenclature. Structural and Stereoisomerism: types of structural isomers; types of stereoisomers (cis and trans; mer and fac; sym and asym; optical isomers). Symmetry and Point Groups: determination of symmetry elements and operations; molecular point group determination; symmetry and dipole moment and chirality. Synthetic Reactions: addition, substitution, dissociation, redox, and reactions of coordinated ligands; catalytic processes; inertness and lability; chelate effect; trans-effect; reactions in non-aqueous media. Crystal field theory: Magnetic properties and CF stabilization energy; electronic absorption spectra; spectrochemical series; Jahn-Teller effect; thermodynamics and crystal field effects. Term symbols. Slater-condon parameters for atoms and ions of the first transition period. Special Topics in Coordination Chemistry: metal-metal bonds; solar energy conversion. Calculations using Orgel diagrams, Explain the difference between Orgel and Tanabe-Sugano diagrams. Mechanisms of ligand substitutions, small molecule activation and transition metal-catalysed reactions will be discussed.

Bibliography of literature

A. Literature required to pass the course

A. Bielański – Podstawy chemii nieorganicznej, tom 1 i 2.
M. Cieślak-Golonka, J. Starosta, M. Wasielewski – Wstęp do chemii koordynacyjnej
B. Literatura uzupełniająca
Coordination Chemistry Reviews – czasopismo naukowe

B. Extracurricular readings

Knowledge

By the end of the course, the student must be able to:
Recall typical ligands; name typical coordination compounds and describe their geometry Judge the existence of isomers and draw such isomers; Calculate the oxidation states of metals and the number of d electrons.
Apply soft-hard acid-base theory to predict the stability of complexes; interpret chelate effect; determine the relative stability of complexes according to structural factors.
Deduce the crystal field splitting diagram for octahedral, tetrahedral, and square planar complexes; decide the electronic configuration. Generate the ligand field diagram for octahedral complexes.
Decide if a complex is high spin or low spin using ligand field theory; understand and explain the spectrochemical series.
Estimate the spin-only magnetic moment of complexes according to ligand field theory; Determine whether an electronic transition is allowed and the intensity of such transition.
Describe various metal-ligand interactions in terms of sigma- and pi-bonding interactions.
Explain the stability of d-metal complexes, their reactivity, and the mechanisms of ligand substitution reactions.

Skills

Skills to solve problems related to coordination chemistry.
Skills to solve problems related to structural coordination chemistry.
Skills to solve problems related to the reactivity of complex compounds.
Skills to solve problems associated with spectroscopy and magnetism in complexes.
The general skills that should be acquired by the student and in which the course aims at are:
Search, analysis and synthesis of data and information and making decisions.
Turning theory into practice.
Promotion of free, creative and inductive thinking.
Independent and teamwork.
Acquisition of the appropriate theoretical and practical knowledge base to enable the further training both in theory (in more specific subjects of Coordination Chemistry) and in laboratory.

Social competence

Search for, analysis and synthesis of data and information, with the use of the necessary technology.
Adapting to new situations.
Decision-making.
Working independently.
Team work.
Working in an interdisciplinary environment.
Production of new research ideas.
Showing social, professional and ethical responsibility criticism and self-criticism.

Production of free, creative and inductive thinking.