GHENT UNIVERSITY

Course Specifications

From the academic year 2016-2017 up to and including the

Physical Chemistry I : Chemical Thermodynamics (C003078)

Course size (nominal values; actual values may depend on programme)

Credits	5.0	Study time	150 h	Contact hrs	58.5 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 2)	Dutch	seminar: coached exercises	36.25 h
		lecture	22.5 h

Lecturers in academic year 2018-2019

Hens, Zeger	WE06	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Bachelor of Science in Chemistry	5	A

Teaching languages

Dutch

Keywords

Thermodynamics, Equilibrium Conditions, Physical Equilibrium, Chemical Equilibrium, Surfaces

Position of the course

'Physcial chemistry I, chemical thermodynamics' is a basic course. It aims for (1) a thorough knowledge of the principle laws of thermodynamics and the most important thermodynamic functions of state in a chemical context, (2) the application of thermodynamics in chemistry, in particular on physical equilibria, chemical equilibrium and the role of surfaces and interfaces and (3) the connection between thermodynamic quantities and the molecular structure of matter. The focus lies on a knowledge of concepts in chemical thermodynamics and an understanding of the connection between physics and chemistry.

Contents

- Working method of thermodynamics.
- Gasses and intermolecular forces: the ideal gas - kinetic theory of gases - intermolecular interactions - the vanderWaals-gas.
- Energy: the first law of thermodynamics - changes of internal energy and enthalpy in physicochemical processes - thermochemistry.
- Entropy: the second law of thermodynamics - entropy of gasses and gas mixtures - entropy changes in physicochemical processes - the third law of thermodynamics.
- Gibbs free energy: specific formulations of the second law - free energy changes in physicochemical processes - the chemiscal potential - equilibrium in physicochemical systems.
- Equilibrium in pure substances: the phase diagram - thermodynamics of equilibrium lines - refigeration - liquid pressure and vapour pressure.
- Binary mixtures: ideal mixtures - ideally dilute mixtures - the lattice model
- Solubility: gases in liquids - solids in liquids -liquid/liquid equilibrium- hydrophobic effect
- Phase diagrams: the phase rule, pressure/composition and temperature/composition diagram of the ideal binary mixture - liquid/liquid diagram - eutectic diagram
- Non-ideality: non-ideal gases, fugaciy - non-ideal liquid mixtures, activity - liquid-liquid equilibrium - azeotropy.
- Chemical equilibrium: formal treatment of chemical equilibrium - homogeneous chemical equilibrium - heterogeneous equilibrium - coupled equilibria - manipulation of chemical equilibrium.
- Surfaces and interfaces: surface tension - thermodynamic description of interfaces - thermodynamics of drops and bubbles - surfactants- adsorption at surfaces.

Initial competences

Students starting in the second your of the bachelor have a knowledge of thermodynamics from courses in physics and a basic knowledge in chemistry, including organic chemistry. This makes the necessary starting point to achieve the objectives of the course: the application of thermodynamics in a chemical context. Therefore students need to have obtained credits for the following courses in the chemistry curriculum or have successfully followed other courses with a similar content: “Mathematics I: Fundamental Methods”, “Mathematics II: Fundamental Methods in Mathematics and Statistics”, “Physics I: Mechanics”, “Physics II: Waves, Optics and Thermodynamics”, “Chemistry I: Structure of Matter” and “Chemistry II: Changes in Matter”.

Final competences

1 The student has insight in the relation between thermodynamics, chemistry and the molecular structure of matter.
2 The student understands phase equilibria of pure substances and binary mixtures.
3 The student can analyse chemical equilibria and related them to the thermodynamics of a chemical reaction.
4 The student understands the influence surfaces may have on thermodynamic equilibria.
5 The student can solve chemical problems by a reasoning that starts from physical/thermodynamic arguments.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Lecture, seminar: coached exercises

Learning materials and price

Dutch course book and exercise book.
Background and links on Minerva.

References

'Physical Chemistry' van P.W. Atkins

Course content-related study coaching

Practical courses in which the subject matter is learned by (half)individually solving exercices (semi)individually and in which the possibility of asking questions is offered. Interactive discussions on minerva.

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination, oral examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination, oral examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Examination will be on the lectures (oral with written preparation) and on the practical courses (written). Ratio: 60-40. The examination will stress the insight in the pysical background and the ability to apply thermodynamic knowledge on chemical problems and to interpret this in terms of the molecular structure of matter.

Calculation of the examination mark

Theory exam: 12/20
Exercises: 8/20