**City University of Hong Kong**
**Course Syllabus**

**offered by Department of Chemistry**
**with effect from Semester A 2018/19**

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**Part I Course Overview**

| | |
|---|---|
| **Course Title:** | Principles of Inorganic Chemistry |
| **Course Code**: | BCH2006 (and BCH2006A) |
| **Course Duration:** | 1 semester |
| **Credit Units**: | 4 (3) credits |
| **Level**: | B2 |
| **Proposed Area:** *(for GE courses only)* | ☐ Arts and Humanities<br>☐ Study of Societies, Social and Business Organisations<br>☐ Science and Technology |
| **Medium of Instruction:** | English |
| **Medium of Assessment:** | English |
| **Prerequisites**: *(Course Code and Title)* | Nil |
| **Precursors**: *(Course Code and Title)* | Nil |
| **Equivalent Courses**: *(Course Code and Title)* | Nil |
| **Exclusive Courses**: *(Course Code and Title)* | Nil |

**Note: BCH2006A does not contain any practical component, and has a credit unit value of three (3).**

## Part II Course Details

### 1. Abstract

*(A 150-word description about the course)*

The aim of this course is to allow students to develop an understanding of the basic principles and modern concepts of inorganic chemistry from a discovery approach with an emphasis on atomic structures and properties, chemical bonding and coordination chemistry; Students undertaking BCH2006 will also acquire practical experience on inorganic chemistry experiments.

### 2. Course Intended Learning Outcomes (CILOs)

*(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)*

| No. | CILOs# | Weighting* (if applicable) (BCH2006) | Weighting* (if applicable) (BCH2006A) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) | | |
|---|---|---|---|---|---|---|
| | | | | *A1* | *A2* | *A3* |
| 1. | Relate the atomic structures of elements with their physical and chemical properties. | 20% | 25% | ✓ | | |
| 2. | Apply Lewis structures, Valence-Shell Electron-Pair Repulsion Theory, Valence Bond Theory and Molecular Orbital Theory to explain the physical and chemical properties of molecules, leading to the design and discovery of new molecules. | 25% | 25% | ✓ | ✓ | |
| 3. | Describe possible isomerism of a metal complex and explore the role of the electronic configuration of a metal complex on its coordination number, geometry and reactivity. | 15% | 15% | ✓ | | |
| 4. | Predict and explain the colour, stability, geometry and magnetic properties of a metal complex using Valence Bond Theory and Crystal Field Theory. | 15% | 20% | ✓ | ✓ | |
| 5. | Explain the properties of solvents, acids and bases. | 15% | 15% | ✓ | | |
| 6. | Apply principles and synthetic techniques to conduct inorganic chemistry experiments from a discovery approach. | 10% | 0% | | ✓ | ✓ |
| | | 100% | 100% | | | |

** If weighting is assigned to CILOs, they should add up to 100%.*

*# Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.*

*A1: Attitude*
*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

*A2: Ability*
*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.*

A3: *Accomplishments*
*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

## 3. Teaching and Learning Activities (TLAs)

*(TLAs designed to facilitate students' achievement of the CILOs.)*

| TLA | Brief Description | CILO No. | | | | | | Hours/week (if applicable) |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Lectures and tutorials | Students will develop an understanding on atomic structures and correlation with the physical and chemical properties in lectures and tutorials from a discovery approach. | ✓ | | | | | | 0.5 |
| Lectures and tutorials | In lectures and tutorials, students will apply various theories to explore, predict and explain the structures, bonding and properties of simple molecules, leading to the design and discovery of new molecules. | | ✓ | | | | | 1 |
| Lectures and tutorials | Students will develop an understanding of isomerism of a metal complex and correlate properties of a metal complex with its electronic configuration in lectures and tutorials. | | | ✓ | | | | 0.5 |
| Lectures and tutorials | In lectures and tutorials, students will apply Valence Bond Theory and Crystal Field Theory to explain various properties of a metal complex from a discovery approach. | | | | ✓ | | | 0.5 |
| Lectures and tutorials | Students will develop an understanding of solvents, acids and bases and predict their properties in lectures and tutorials. | | | | | ✓ | | 0.5 |
| Experiments and written reports | Students, in the form of small groups, will conduct inorganic chemistry experiments from a discovery approach, and present their results in written reports. (BCH2006 only) | | | | | | ✓ | 2 |

## 4. Assessment Tasks/Activities (ATs)

*(ATs are designed to assess how well the students achieve the CILOs.)*

(BCH2006 only)

| Assessment Tasks/Activities | CILO No. | | | | | | Weighting* | Remarks |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | | |
| Continuous Assessment: 30% | | | | | | | | |
| Tutorial Questions and Assignments | ✓ | ✓ | ✓ | ✓ | ✓ | | 10% | |
| Tests | ✓ | ✓ | ✓ | ✓ | ✓ | | 10% | |
| Lab Reports | | | | | | ✓ | 10% | |
| Examination: 70% (duration: 3 hours) | | | | | | | | |
| ** The weightings should add up to 100%.* | | | | | | | 100% | |

(BCH2006A only)

| Assessment Tasks/Activities | CILO No. | | | | | Weighting* | Remarks |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| Continuous Assessment: 30% | | | | | | | |
| Tutorial Questions and Assignments | ✓ | ✓ | ✓ | ✓ | ✓ | 15% | |
| Tests | ✓ | ✓ | ✓ | ✓ | ✓ | 15% | |
| Examination: 70% (duration: 3 hours) | | | | | | | |
| ** The weightings should add up to 100%.* | | | | | | 100% | |

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for BCH courses:

***"A minimum of 40% in both coursework and examination components."***

## 5. Assessment Rubrics

*(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)*

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Fair (C+, C, C-) | Marginal (D) | Failure (F) |
|---|---|---|---|---|---|---|
| 1. Tutorial questions and assignments | ABILITY to develop an understanding on basic concepts of inorganic chemistry | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 2. Tests | ABILITY to describe and explain basic concepts of inorganic chemistry to solve problems | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 3. Lab reports (BCH2006 only) | ABILITY to conduct inorganic chemistry experiments and present results in written reports | High | Significant | Moderate | Basic | Not even reaching marginal levels |
| 4. Examination | ABILITY to describe, explain, and integrate basic concepts of inorganic chemistry and apply them to solve problems | High | Significant | Moderate | Basic | Not even reaching marginal levels |

**Part III Other Information** (more details can be provided separately in the teaching plan)

## 1. Keyword Syllabus

*(An indication of the key topics of the course.)*

Atomic Structure

The quantisation of energy. Bohr's theory of the hydrogen atom. Quantum theory and atomic orbitals. Many-electron atoms.

Atomic Properties

Atomic radii. Ionisation energies. Electron affinities. Electronegativity. Periodic trends.

Chemical Bonding

Lewis structures. Resonance. VSEPR method and molecular geometry. Hybrid orbitals. Molecular orbitals. Bonding in solids.

Coordination Chemistry

Coordination numbers and coordination geometries. Types of ligands. Bonding. Reactivity of coordination compounds.

Solvents, Solutions, Acids and Bases

Solvent properties. Definitions of acids and bases. Hard and soft acid base concepts.

## 2. Reading List

### 2.1 Compulsory Readings

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

| | |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| … | |

### 2.2 Additional Readings

*(Additional references for students to learn to expand their knowledge about the subject.)*

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|---|---|
| 1 | Inorganic Chemistry 6th Edition, Duward Shriver, Mark Weller, Tina Overton, Fraser Armstrong, Jonathan Rourke, Publisher: W. H. Freeman, 2014. |
| 2. | Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson, P. L. Gaus, 2nd Edition, Wiley, New York, 1995. |