City University of Hong Kong
Course Syllabus

offered by Department of Chemistry
with effect from Semester A 2022/2023

Part I Course Overview

Course Title:	Advanced Inorganic Chemistry
Course Code:	CHEM8130
Course Duration:	1 semester
Credit Units:	4 credits
Level:	R8
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)*	BCH8130 Advanced Inorganic Chemistry
Exclusive Courses: *(Course Code and Title)*	Nil

Part II Course Details

1. Abstract

This course is a postgraduate taught course tailored for postgraduate research students only.

The aim of this course is to help students to develop an understanding of the principles and concepts of modern inorganic chemistry with an emphasis on the role of transition metals in inorganic redox reaction mechanisms, metalloproteins, and inorganic photophysics and photochemistry.

2. Course Intended Learning Outcomes (CILOs)

No.	CILOs#	Weighting* (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Analyse the principles for the extraction of various elements from their ores based on redox potentials and Ellingham diagrams.		✓	✓	
2.	Evaluate the redox stability of inorganic species in water and the products of inorganic redox reactions using Latimer diagrams, Frost diagrams and Pourbaix diagrams.		✓	✓	
3.	Analyse the rate of mechanism of an inorganic electron transfer reactions using Marcus Theory.			✓	✓
4.	Evaluate the roles of transition metal centres and amino acid residues on the structural and functional properties of metalloproteins.		✓	✓	
5.	Analyse the photophysical and photochemical properties of inorganic and organometallic transition metal complexes.		✓	✓	
6.	Discover examples encountered in our daily lives that involve the applications of transition metal systems.				✓
		100%			

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)

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2	3	4	5	6	
Group activities	Teaching and learning will be based on large and small group activities in which the principles of extraction of various elements will be examined and discussed.	✓						
Group activities	In large and small group activities the basic concepts of Latimer diagrams, Frost diagrams and Pourbaix diagrams will be examined and discussed.		✓					
Group critical evaluation tasks	In large and small group critical evaluation tasks students will discuss and rationalise the various factors affecting the rate of electron transfer reactions.			✓				
Group activities	Teaching and learning will be in the form of large and small group activities; students will develop an understanding on the structural and functional properties of metalloproteins.				✓			
Group activities	In large and small group activities, students will discuss and examine the photophysical and photochemical properties of inorganic and organometallic transition metal complexes.					✓		
Literature search and presentation	Students, in small groups, will take part in the literature search on identification of their daily life encounters related inorganic chemistry. They will then present, evaluate and discuss their findings in the light of modern day living in the form of written reports and oral presentations.						✓	

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.						Weighting*	Remarks
	1	2	3	4	5	6		
Continuous Assessment: 30%								
Short Quizzes and Tutorial Questions	✓	✓	✓	✓	✓		5%	
Assignments	✓	✓	✓	✓	✓		10%	
Tests	✓	✓	✓	✓	✓		10%	
Written Reports and Group Presentations						✓	5%	
Examination: 70% (duration: 3 hours)								
							100%	

Starting from Semester A, 2015-16, students must satisfy the following minimum passing requirement for courses offered by CHEM:
"A minimum of 40% in both coursework and examination components."

5. Assessment Rubrics

Applicable to students admitted in Semester A 2022/23 and thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Short Quizzes and Tutorial Questions	ABILITY to develop an understanding on the concepts of element extraction; Latimer, Frost and Pourbaix diagrams; electron transfer; bioinorganic chemistry; and inorganic photochemistry	High	Significant	Basic	Not even reaching marginal levels
2. Assignments	ABILITY to develop an understanding on the aforementioned concepts	High	Significant	Basic	Not even reaching marginal levels
3. Tests	ABILITY to describe and explain the aforementioned concepts to solve problems	High	Significant	Basic	Not even reaching marginal levels
4. Written Reports and Group Presentations	ABILITY to conduct literature search and give written and oral presentations on different topics on inorganic chemistry at the advanced level	High	Significant	Basic	Not even reaching marginal levels
5. Examination	ABILITY to describe, explain, and integrate the aforementioned concepts and apply them to solve problems	High	Significant	Basic	Not even reaching marginal levels

Applicable to students admitted before Semester A 2022/23

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Short Quizzes and Tutorial Questions	ABILITY to develop an understanding on the concepts of element extraction; Latimer, Frost and Pourbaix diagrams; electron transfer; bioinorganic chemistry; and inorganic photochemistry	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Assignments	ABILITY to develop an understanding on the aforementioned concepts	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Tests	ABILITY to describe and explain the aforementioned concepts to solve problems	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Written Reports and Group Presentations	ABILITY to conduct literature search and give written and oral presentations on different topics on inorganic chemistry at the advanced level	High	Significant	Moderate	Basic	Not even reaching marginal levels
5. Examination	ABILITY to describe, explain, and integrate the aforementioned concepts and apply them to solve problems	High	Significant	Moderate	Basic	Not even reaching marginal levels

Part III Other Information

1. Keyword Syllabus

Oxidation and Reduction
Extraction of the elements. Ellingham diagrams. Redox potentials. Redox stability in water. Latimer diagrams, Frost diagrams and Pourbaix diagrams.

Inorganic Reaction Mechanisms
Inner-sphere and outer-sphere electron transfer reactions. Marcus theory. Factors affecting rates of reactions.

Metalloproteins
Role of transition metal centres and amino acid residues. Structures and functions of selected metalloproteins.

Inorganic Photochemistry
Absorption and emission properties of luminescent transition metal complexes. Excited-state nature. Energy- and electron-transfer. Potential applications.

2. Reading List

2.1 Compulsory Readings

1.	
2.	
3.	
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2.2 Additional Readings

1.	*Inorganic Chemistry*, Shriver and Atkins, 3rd Edition, Oxford University Press, Oxford 1999.
2.	*Basic Inorganic Chemistry*, Cotton, Wilkinson and Gaus, 3rd Edition, J. Wiley, 1995.
3.	*Advanced Inorganic Chemistry*, Cotton and Wilkinson, 5th Edition, Wiley, 1988.
4.	*Principles of Bioinorganic Chemistry*, Lippard and Berg, University Science Books, 1994.
5.	Photochemistry of Polypyridine and Porphyrin Complexes, Kalyanasundaram, Academic Press, 1992.