

SUBJECT OUTLINE DETAILS

1. Subject: General and Inorganic Chemistry 2 (Hóa Đại cương và Vô cơ 2)

- Code: CH142C
- Credits: 3
- Hours: 30 theory hours + 15 practice hours

2. Management Unit:

- Department: Chemistry
- Faculty: Natural Sciences

3. Prerequisites: General Chemistry 1

4. Subject objectives:

4.1. Knowledge:

By the end of this course, students will be able to:

- 4.1.1. Understand the concept and perform calculations related to thermodynamic parameters including enthalpy, entropy, and free energy.
- 4.1.2. Identify and complete oxidation-reduction processes. Discuss the construction and operation of galvanic and electrolytic electrochemical cells, and determine standard and nonstandard cell potentials.
- 4.1.3. Determine the rate of a reaction and its dependence on concentration, time, and temperature. Be familiar with the terms elementary steps, rate determining step, reaction mechanisms, and steady-state approximation.
- 4.1.4. Describe basic principles of chemistry for representative elements and some fundamentals of coordination compounds such as nomenclature, isomerism, and color of transition metal complexes.

4.2. Skill:

In addition to learning objectives, the course will provide students other skills as follows:

- 4.2.1. Critical Thinking: To include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.
- 4.2.2. Communication: To include effective development, interpretation and expression of ideas through written, oral, and visual communication.
- 4.2.3. Empirical & Quantitative: To include the manipulation and analysis of numerical data or observable facts resulting in informed conclusion.
- 4.2.4. Teamwork: To include the ability to connect choices, ideas; to interact, discuss and pose questions; as well as to respect other opinions and defend the arguments.

4.3. Attitude:

5. The course also provides an opportunity to set up and develop personal characteristics necessary for scientific activities such as curiosity, persistence, and concentration. A successful student will bear a balance between scepticism and receptivity, a love for science and self confidence.

5. Brief description of subject content:

To achieve the goals above, students will be introduced to the following concepts:

- Energy and chemical reactions: Heat, work and the 1st law of thermodynamics; Entropy and 2nd law of thermodynamics; The Gibbs free energy and chemical equilibrium; Calorimetry and calorimeter.
- Principles of reactivity: Reaction rates, reaction orders, rate laws, rate constants, theoretical models for chemical kinetics, Arrhenius equation, catalysis, reaction mechanisms, deriving a rate law from a mechanism.
- Electrochemistry: Oxidation-reduction reactions, voltaic cells, standard cell potentials, Nernst equation, applications of voltaic cells; electrolytic cells, quantitative electrolysis.
- Descriptive chemistry: introduction to certain properties and reactivities of several representative elements. Investigate the origins, commercial and biological applications of a number of inorganic compounds.
- Chemistry of coordination compounds: Ligands, coordination numbers, nomenclature, structural isomers and stereoisomers, crystal field splitting, high and low spin complexes, magnetic properties and color of complexes.

6. Subject content structure:

	Contents	Hours	Goals
Chapter 1.	Energy & Chemical Reactions	10	
1.1.	Energy, heat, work and the 1 st law of thermodynamics	2	4.1.1; 4.2; 4.3
1.2.	Hess law	1	4.1.1; 4.2; 4.3
1.3.	Entropy and 2 nd law of thermodynamics	2	4.1.1; 4.2; 4.3
1.4.	The Gibbs free energy and equilibrium	2	4.1.1; 4.2; 4.3
1.5.	Calorimetry and calorimeter	1	4.1.1; 4.2; 4.3
1.6.	Problems	2	4.1.1; 4.2; 4.3
Chapter 2.	Principles of Reactivity	10	
2.1.	Reaction rates	1	4.1.2; 4.2; 4.3
2.2.	Rate laws and reaction orders	2	4.1.2; 4.2; 4.3
2.3.	Theoretical Models for Chemical Kinetics	1	4.1.2; 4.2; 4.3
2.4.	The Arrhenius Equation	1	4.1.2; 4.2; 4.3
2.5.	Reaction Mechanisms	1	4.1.2; 4.2; 4.3
2.6.	Deriving a Rate Law From a Mechanism: Steady-state approximation	2	4.1.2; 4.2; 4.3
2.7.	Problems	2	4.1.2; 4.2; 4.3
Chapter 3.	Introduction to Electrochemistry	10	
3.1.	Electrochemical Reactions	1	4.1.3; 4.2; 4.3

3.2. Balancing Redox Reactions: half-reaction method	2	4.1.3; 4.2; 4.3
3.3. Galvanic Cells	1	4.1.3; 4.2; 4.3
3.4. Standard Redox Potentials and E_{cell}	1	4.1.3; 4.2; 4.3
3.5. Nernst equation	1	4.1.3; 4.2; 4.3
3.6. Free Energy and E_{cell}	1	4.1.3; 4.2; 4.3
3.7. Electrolysis and Faraday's laws	1	4.1.3; 4.2; 4.3
3.8. Problems	2	4.1.3; 4.2; 4.3
Chapter 4. The Chemistry of non-metal Elements	7	
4.1. Boron	1	4.1.4; 4.2; 4.3
4.2. Pnictogens	1	4.1.4; 4.2; 4.3
4.3. Chalcogens	1	4.1.4; 4.2; 4.3
4.4. Halogens	2	4.1.4; 4.2; 4.3
4.5. Problems	2	4.1.4; 4.2; 4.3
Chapter 5. Introduction to Coordination Compounds	8	
5.1. Some Concepts: ligand, coordination number, chelate and chelate effects	1	4.1.4; 4.2; 4.3
5.2. Nomenclature	1	4.1.4; 4.2; 4.3
5.3. Structures and Isomerism	2	4.1.4; 4.2; 4.3
5.4. Crystal Field Theory	1	4.1.4; 4.2; 4.3
5.5. Magnetic property and color of the transition metal complexes	1	4.1.4; 4.2; 4.3
5.6. Problems	2	4.1.4; 4.2; 4.3

7. Teaching method:

Lecture; discussion; demonstration; self-learning; group-working

8. Duties of student:

Students have to do the following duties:

- No food, drinks, or use of tobacco products in class.
- Telephones, headphones, and any other electronic devices must be turned off while in class.
- Late assignments will be not accepted.
- Students that miss a test must make up the test the day they return to class. It is the student's responsibility to make arrangements to make up test.
- Only two absences are allowed during the course. If a student is tardy to class or departs early three (3) times, it will be equal to one (1) absence. Each absence beyond two absences will result in a 10% point deduction from your final grade.
- Student who stop coming to class and fails to drop the course will earn an 'F' in the course.
- Academic honesty; dishonesty in any aspect of the course will result in a course failure. Academic dishonesty includes looking at another student's test during an exam, allowing another student to copy your work, use of unauthorized materials (e.g., lecture notes, textbooks, inappropriate, electronic devices) during an exam.

Note: The above policies can be modified by the individual course instructor.

9. Assessment of student learning outcomes:

9.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Attendance	No absence will be accepted	10%	4.1; 4.2; 4.3
2	Exercise	Complete all of assigned exercises	10%	4.1; 4.2; 4.3
3	Midterm Exam	- Written test: Essay + Multiple choice (60 mins)	20%	4.1; 4.2; 4.3
4	Final Exam	- Written test: Essay + Multiple choice (90 mins) - Required	60%	4.1; 4.2; 4.3

9.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.
- Subject score is the sum of all the components of the evaluation multiplied by the corresponding weight. The subject score is marked on a scale of 10 and rounded to one decimal place, then is converted to A-B-C-D score and score on a scale of 4 under the academic provisions of the University.

10. Materials:

Materials information

Code number

- [1] Raymond Chang and Jason Overby, *General Chemistry: The Essential Concepts*, 6th Ed., McGraw-Hill, **2011**.
- [2] Brady and Holum, *Chemistry: the Study of Matter and its Changes*, 2th Ed., John Wiley & Sons, **1996**.
- [3] Geoff Rayner-Canham and Tina Overton, *Descriptive Inorganic Chemistry*, 5th Ed., W. H. Freeman and Company, **2010**.

11. Self-study Guide:

Week	Contents	Hours	Student's Task
1	Chapter 1: Energy & Chemical Reactions 1.1. Energy, heat, work and the 1 st law of thermodynamics 1.2. Hess Law 1.3. Entropy and 2 nd law of thermodynamics 1.4. The Gibbs free energy and equilibrium 1.5. Calorimetry and calorimeter 1.6. Problems	10	Read before the Ref [1] from section 18.1 to 18.7 Homework: Problems of Chapter 18, Ref [1]
2	Chapter 2: Principles of Reactivity	10	Read before the Ref [1] from section

	2.1. Reaction rates 2.2. Rate laws and reaction orders 2.3. Theoretical Models for Chemical Kinetics 2.4. Arrhenius Equation 2.5. Reaction Mechanisms 2.6. Deriving a Rate Law From a Mechanism: Steady-state approximation 2.7. Problems		14.1 to 14.6 Homework: Problems of Chapter 14, Ref [1]
3	Chapter 3: Introduction to Electro-chemistry 3.1. Electrochemical Reactions 3.2. Balancing Redox Reactions: half-reaction method 3.3. Galvanic Cells 3.4. Standard Redox Potentials and E_{cell} 3.5. Nernst equation 3.6. Free Energy and E_{cell} 3.7. Electrolysis and Faraday's laws 3.8. Problems	10	Read before the Ref [1] from section 19.1 to 19.8 Homework: Problems of Chapter 19, Ref [1]
4	Chapter 4. The Chemistry of non-metal Elements 4.1. Boron 4.2. Pnictogens 4.3. Chalcogens 4.4. Halogens 4.5. Problems	7	Read before the following sections in Ref [3]: - 13.1 to 13.5 - 15.1 to 15.9 - 16.1 to 16.24 - 17.1 to 17.14 Homework: Problems of Chapters 13, 15, 16, 17, Ref [3]
5	Chương 5. Đại cương về phức chất 5.1. Some Concepts: ligand, coordination number, chelate 5.2. Nomenclature 5.3. Structures and Isomerism 5.4. Crystal Field Theory 5.5. Magnetic property and color of the transition metal complexes 5.6. Problems	8	Read before the Ref [3] from section 19.1 to 19.8 Homework: Problems of Chapters 19, Ref [3]

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**ON BEHALF OF RECTOR
DEAN/ DIRECTOR**

HEAD OF DEPARTMENT