

Science 4 (Chemistry)

Basic Course Information			
Course Number	chem202	Subject Category	Chemistry
Class Format	Lecture	Quality View and Number of Credits	3.0
Prerequisite	chem101	Student Category	Open
Period of Study	Semester 2	Classes per Week	2
Related Materials	Scientific Methods and Critical Thinking		
Instructor	Dr. Tandra Choudhury	Dr. Lavson Washburn	

Course Objectives
 The course provides students with basic knowledge concepts of non-metallic elements and electrochemistry containing basic reactions, application of electrochemical cell. Students are expected to develop an appreciation of the fundamental laws of thermodynamics and the application of these laws to chemical systems.
 The course also tries to develop students' human skills such as thinking, explaining, discussing and collaborating skills, through role and group works that are pre-requisites for global engineers to create something new.

Evaluation/Level	Identify Level of Achievement (Low level)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
Understanding of non-metallic elements and electrochemistry	Theoretically understand and explain the contents.	Only understanding of the basic terms and contents.	Lacks the appropriate knowledge and understanding.
Understanding key engineering terms and concepts of non-metallic elements	Ability to correctly explain the contents.		
Mathematical and graphical representation	Equations show good understanding and are not supported with sufficient details.	Equations show understanding and are supported with sufficient information.	Equations are limited or incorrect. Graphs are incomplete or absent.

Prerequisite Term Learning Outcomes
GE1 Wide knowledge on Science and Engineering and practical ability to apply them to solve problems in the society.
GE4 Creativity to make a new value with using the knowledge from various fields.
GE5 As an engineer, attitude to act with awareness of social roles and responsibility to make a better society.

Teaching Method
 The class is based on the contents learned in Chemistry 1 through Chemistry 3. Students learn basic concepts and principles of non-metallic elements and electrochemistry. The content and methods are designed to help the students to develop knowledge, problem solving skills and understanding.

Class Format
 Lecture, seminar, and mini lab demonstration

Please Note
 All materials will be covered on the design question. The students are required to keep photo copies or files of all submitted material to ensure further study by ourselves.

Course Plan	Semester 2	Contents and Method of Course	Goals	Related MOO
1st - 7th week		Life Science 2 and Earth Science 2		
8th week		Wrap up for midterm examination	To review and summarize the key concepts and topics covered in the first half of the semester.	
9th week		Mid-term examination	Evaluation of students' comprehension	
10th week		Reflection for midterm examination	Review students' results and the mid-term exam	
		1. Non-metallic elements		
11th week		1.1. Properties of non-metallic elements: C, O, N, S	1) Describe the properties of carbon, oxygen, nitrogen, and sulfur. 2) Explain the importance and need of well-known non-metallic elements.	GE1, GE4, GE5
12th week		1.2. Properties of halogens and inert gases	1) Describe the Group VII halogens, chlorine, bromine and iodine, as diatomic non-metals with general trends in molecular density and decreasing reactivity. 2) Describe the colors and the trends in volatility of halogens, bromine and iodine. 3) Describe and explain the displacement reactions of halogens with other halides ions. 4) Describe the properties of other elements in Group VII, astatine, francium, and describe the Group VIII noble gases as monatomic, non-reactive gases and explain this in terms of electronic configuration.	GE1, GE4, GE5
13th week		1.3. Industrial processing of ammonia and sulfur	1) Describe the production of ammonia and fertilizers. 2) Describe the use of NH ₃ fertilizers to produce the element nitrogen. 3) Describe the production of sulfur and sulfuric acid.	GE1, GE4, GE5
		2. Electrochemistry		
14th week		2.1. Oxidation number	1) Calculate oxidation numbers of elements in compounds and ions. 2) Use changes in oxidation numbers to help balance chemical reactions. 3) Explain and use the terms: redox, oxidation, reduction and disproportionation in terms of electron transfer and changes in oxidation number. 4) Explain and use the terms: oxidizing agent and reducing agent. 5) Use a Roman numeral to indicate the magnitude of the oxidation number of an element.	GE1, GE4, GE5
		2.2. Redox reaction	1) Complete and balance redox reactions using the method of half-reactions. 2) Identify oxidizing agents and reducing agents in a redox reaction. 3) Identify reactions by the color changes that occur when oxidized iron(II) sulfate reacts with potassium dichromate.	GE1, GE4, GE5
		2.3. Galvanic cell: Daniell cell	1) Sketch a voltaic cell and identify its cathode, anode and the direction in which electrons and ions move.	GE1, GE4, GE5
15th - 16th week		2.4. Standard reduction potential	1) Calculate standard emf cell potentials, E ⁰ cell from standard reduction potentials. 2) Use reduction potentials to predict whether a redox reaction is spontaneous. 3) Relate E ⁰ cell to ΔG ⁰ and equilibrium constant.	GE1, GE4, GE5
16th week		2.5. Electrolysis and Faraday's law	1) Predict the identities of substances liberated during electrolysis from the data of electrode half-cell reduction potentials and concentration. 2) Calculate and apply the relationship F = 96,485 between the Faraday constant, F, and the Avogadro constant, L, and charge on the electron, e. 3) Describe the reactions in electrolytic cells.	GE1, GE4, GE5
17th - 18th week		2.6. Applications of electrochemistry	1) Identify the components of a corrosion battery. 2) Describe the corrosion of a metal in water and explain how it works. 3) Describe the construction of a fuel cell and explain how it generates electrical energy. 4) Explain how corrosion occurs and how it is prevented for cathodic protection.	GE1, GE4, GE5
19th week		Review students' results and the final exam	Evaluation of students' comprehension	
20th week		Return of examination scripts and reflection	Review students' results and the final exam	

	Examination	Practical	Workshop	Assess	Other
Major Assign	0	0	0	0	0
Lab Assign	0	0	0	0	0
Workshop Assign	0	0	0	0	0
Finals	50%	25%	12.5%	12.5%	0%