Science 1 (Chemistry)

Basic Course Information

Course Number	03005019	**Subject Category**	Compulsory(G)
Class Format	Lecture	**Credit Type and Number of Credits**	0.75
Department	Electrical and Electronics	**Student Category**	Year 1
Period of Study	Semester 1	**Classes per Week**	3
Required Materials	General Chemistry (First Edition), General Chemistry (Timberlake)		
Instructor	Dr. Tanakorn Wonglakhon	Dr. Wishulada Iniumpi	Dr. Thitipat Chongcharoenchaikul

Course Objective

Chemistry plays a critical role in many areas of engineering, and this course is designed to provide students with an introduction to some of its fundamental concepts. The course will cover atomic structure and the periodic table of elements, which provide the foundation for understanding chemical properties and behavior. Chemical bonding, which is crucial to the formation of new materials and compounds, will also be explored in detail.

In addition to developing a foundational understanding of chemistry, students will also work on developing critical thinking, explanation, discussion, and collaboration skills, which are essential for global engineers to create innovative solutions to complex problems. Solo and group assignments will be given throughout the course to help students build these competencies. By the end of the course, students will be equipped with an appreciation of the fundamental laws and principles of chemistry and how to apply them to solve typical engineering problems.

Evaluation(Rubric)	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
Understanding the concepts and fundamentals of the following contents: 1. Introduction to Chemistry 2. Atomic structure and the Periodic table of elements 3. Chemical Bonding	Theoretically understand and explain the contents. Ability to correctly explain the contents.	Only understanding of the basic terms and contents.	Lacks the appropriate knowledge and understanding.

Relationship with Learning Outcomes

G(1) Wide knowledge on Science and Engineering and practical ability to apply them to solve problems in the society.

G(4) Creativity to make a new value with fusing the knowledge from various fields.

G(5) As an engineer, attitude to act with awareness of social roles and responsibility to make a better society.

Teaching Method

Outline:	Students will be introduced to chemistry, atomic structure and the periodic table of elements, and chemical bonding. The worksheet and workbook are designed to help the students to develop knowledge, problem solving skills and understanding.
Class Format:	Lecture/exercise
Please Note :	All materials will be posted on the Google classroom. The students are requested to keep photo copies or files of all submitted material to ensure further study by oneselves.

Course Plan

Semester 1	Contents and Method of Course	Goals	Related MCC
1st - 7th week	Life Science 1 and Earth Science 1		
8th week	Wrap-up of first half of semester	To review and summarize the key concepts and topics covered in the first half of the semester.	
9th week	Midterm Examination	Evaluation of students' comprehension	
10th week	Return of examination script and reflection	Review students' results and the mid-term exam	
11th week	**1. Introduction to Chemistry**		
	1.1. Why to learn chemistry Solution	1) Describe the importance of chemistry in our daily life.	Ⅱ-C 1 1
		2) Understand the relationship between chemistry and daily life.	Ⅱ-C 1 2
	1.2. Classification of matter	1) Describe the differences between elements, compounds and mixtures.	Ⅱ-C 1 3 Ⅱ-C 1 4 Ⅱ-C 1 5 Ⅱ-C 1 6
	1.3. Physical and chemical properties of matter	1) Classify the properties of matter in terms of physical or chemical properties.	
	1.4. Measurements and separation methods	1) Write the names and abbreviations for the metric or SI units used in measurements of length, volume, mass, temperature, and time. 2) Write a conversion factor for two units that describe the same quantity. 3) Use conversion factors to change from one unit to another. 4) Name appropriate apparatus for the measurement of time, temperature, mass and volume, including stopwatches, thermometers, balances, burettes, volumetric pipettes, measuring cylinders, and gas syringes. 5) Describe and explain methods of separation and purification using a suitable solvent, filtration, crystallization, simple distillation, fractional distillation, and chromatography. 6) Suggest suitable separation and purification techniques with the given information about the substances. 7) Identify substances and assess their purity using melting point and boiling point information.	Ⅱ-C 1 7
12th week	**2. Atomic structure and the Periodic table of elements**		
	2.1. Atomic theories	1) Understand and explain the discovered of atomic models. 2) Explain the results of Thompson's cathode tube experiment. 3) Explain the results of Rutherford's thin gold foil experiment.	
	2.2. Atomic structure	1) Understand that atoms are mostly empty space surrounding a very small, dense nucleus that contains protons and neutrons; electrons are found in shells in the empty space around the nucleus.	
	2.3. Atomic number, mass number, isotope	1) Identify and describe protons, neutrons, and electrons in terms of their relative charges and relative masses. 2) Understand the terms atomic and proton number, mass, and nucleon number. 3) Describe the distribution of mass and charge within an atom. 4) Determine the numbers of protons, neutrons and electrons present in both atoms and ions given atomic or proton number, mass or nucleon number and charge. 5) Define isotopes as different atoms of the same element that have the same number of protons but different numbers of neutrons. 6) Understand the notation ^x_yA for isotopes, where x is the mass or nucleon number, and y is the atomic or proton number. 7) State that and explain why isotopes of the same element have the same chemical properties. 8) State that and explain why isotopes of the same element have different physical properties, limited to mass and density. 9) Calculate the relative atomic mass of an element from the relative masses and abundances of its isotopes.	Ⅱ-C 1 [illegible] Ⅱ-C 1 13 Ⅱ-C 1 14 Ⅱ-C 1 15 Ⅱ-C 1 18 Ⅱ-C 1 30 Ⅱ-C 1 31
	2.4. Electron configurations	1) Understand the terms: shells, sub-shells, orbitals, principal quantum number (n), ground state, and limited to electronic configuration. 2) Describe the number of orbitals making up s, p and d sub-shells, and the number of electrons that can fill s, p and d sub-shells. 3) Describe the order of increasing energy of the sub shells within the first three shells and the 4s and 4p sub-shells. 4) Describe the electronic configurations to include the number of electrons in each shell, sub-shell, and orbital. 5) Explain the electronic configurations in terms of energy of the electrons and inter-electron repulsion. 6) Determine the electronic configuration of atoms and ions given the atomic or proton number and charge.	Ⅱ-C 1 16 Ⅱ-C 1 17 Ⅱ-C 1 18 Ⅱ-C 1 20
13th week	2.5. Periodic Table and trends	1) Describe the Periodic Table as an arrangement of elements in periods and groups and in order of increasing proton number (atomic number). 2) Describe the change from metallic to non-metallic character across a period. 3) Describe the relationship between group number and the charge of the ions formed from elements in that group. 4) Explain similarities in the chemical properties of elements in the same group of the Periodic Table in terms of their electronic configuration. 5) Explain how the position of an element in the Periodic Table can be used to predict its properties. 6) State and explain qualitatively the variations in atomic radius and ionic radius across a period and down a group. 7) State and explain the trends in electronegativity across a period and down a group of the Periodic Table. 8) State and explain the trends in ionization energy and electron affinity across a period and down a group of the Periodic Table. 9) Explain how electron affinity and ionization energy are related, and how irregularities in the periodic trends for electron affinity can be related to electron configuration. 10) Explain the differences in chemical and physical properties of metals and nonmetals, including the basicity of metal oxides and the acidity of nonmetal oxides.	Ⅱ-C 1 21 Ⅱ-C 1 47
14th week	**3. Chemical Bonding**		
	3.1. Lewis dot symbol	1) Write Lewis symbols for atoms and ions.	Ⅱ-C 1 19 Ⅱ-C 1 22
	3.2. Ionic bonding	1) Describe the formation of positive ions, known as cations, and negative ions, known as anions. 2) State that an ionic bond is a strong electrostatic attraction between oppositely charged ions. 3) Describe the giant lattice structure of ionic compounds as a regular arrangement of alternating positive and negative ions. 4) Describe the formation of ionic bonds between ions of metallic and non-metallic elements. 5) Explain in terms of structure and bonding the properties of ionic compounds: high melting points and boiling points, good electrical conductivity when aqueous or molten and poor when solid.	Ⅱ-C 1 19 Ⅱ-C 1 22 Ⅱ-C 1 23 Ⅱ-C 1 24 Ⅱ-C 1 25
15th - 17th week	3.3. Metallic bonding	1) Define metallic bonding as the electrostatic attraction between positive metal ions and delocalized electrons. 2) Explain in terms of structure and bonding the properties of metals: good electrical conductivity, malleability, and ductility.	Ⅱ-C 1 28 Ⅱ-C 1 29
	3.4. Covalent bonding	1) Define that covalent bond is formed when a pair of electrons is shared between two atoms leading to noble gas electronic configurations. 2) Describe the formation of covalent bonds in simple molecules. 3) Understand that elements in period 3 can expand their octet including in the compounds. 4) Describe covalent bonds in terms of orbital overlap giving σ and π bonds: σ bonds are formed by direct overlap of orbitals between the bonding atoms, π bonds are formed by the sideways overlap of adjacent p orbitals above and below the σ bond. 5) Describe how the σ and π bonds form in molecules. 6) Explain in terms of structure and bonding the properties of simple molecular compounds: low melting points and boiling points in terms of weak intermolecular forces (specific types of intermolecular forces are not required), poor electrical conductivity. 7) State and explain the shapes of, and bond angles in, molecules by using VSEPR theory. 8) Predict the shapes of, and bond angles in, molecules and ions. 9) Describe the giant covalent structures.	Ⅱ-C 1 26 Ⅱ-C 1 27
18th week	3.5. Intermolecular forces	1) Describe hydrogen bonding, limited to molecules containing N-H and O-H groups, including ammonia and water as simple examples. 2) Use the concept of electronegativity to explain bond polarity and dipole moments of molecules. 3) Describe van der Waals' forces as the intermolecular forces between molecular entities other than those due to bond formation, and use the term van der Waals' forces as a generic term to describe all intermolecular forces. 4) Describe the types of van der Waals' force: instantaneous dipole – induced dipole (id-id) force, London dispersion forces, permanent dipole – permanent dipole (pd-pd) force, including hydrogen bonding. 5) Describe hydrogen bonding and understand that hydrogen bonding is a special case of permanent dipole – permanent dipole force between molecules where hydrogen is bonded to a highly electronegative atom. 6) State that, in general, ionic, covalent and metallic bonding are stronger than intermolecular forces.	
19th week	Final Examination	Evaluation of students' comprehension	
20th week	Return of examination script and reflection	Review students' results and the final exam	

Do not [illegible]

	Examination	Presentation	Worksheet	[illegible]	[illegible]	Other
Basic Ability	30	10	20	5	0	0
Technical Ability	30	5	0	0	0	0
Interdisciplinary Ability	0	0	0	0	0	0

	Physics	Chemistry	Life Science	Earth Science
Ratio of subjects for evaluation Science subjects	50%	25%	12.5%	12.5%