Science 1 (Chemistry)

Basic Course Information		Subject Information	
Course Code	1GA0044	Subject Code	1GA0044
Class Format	Lecture	Credit Type and Credits	Major 2
Year and Term	1st Year, 1st Term	Course Taught in	English
Prerequisite Courses	Mathematics 1	Offered to Exchange Students	Yes
Delivered	Face-to-face		

Course Planning

Science 1 is a course that helps to make sense of engineering and it is crucial to design and innovate by students with an appreciation for the science behind the technology. Science also will help students to understand the periodic table of elements, which provides the foundation for understanding chemical properties and their uses. Chemical bonding, which is the basis for the formation of molecules and compounds, is also covered in this course.

In addition, to developing a foundational understanding of chemistry, students will also work on developing critical thinking, collaboration, discussion, and collaboration skills, which are essential for global engineers to make it successful. Students will also learn how to apply their knowledge of chemistry to real-world problems, such as the design of new materials. Immediately by the end of the course, students will be equipped with an appreciation for the fundamental science and practical concepts, and basics skills to work and collaborate with various students.

Evaluation Policy			
	Needs Improvement (Below Standard)	Meets Standard (Achievement Level)	Exceeds Standard (Achievement Level)
Evaluation Policy	Inadequate knowledge of the following concepts: Hardly incorrectly applies the contents	Basic understanding of the following concepts: Can understand the basic concepts and contents	Leads the appropriate discussion with understanding

Course Learning Outcomes

CO1 Basic knowledge on Science and Engineering and practical skills to apply them to solve problems in Engineering.
CO2 Creativity to make a new value with fusing the knowledges from various fields.
CO3 Communication skills
CO4 To an maximum attitude to set with awareness of social roles and responsibility to realize a better society

Classroom Policies	
Outline	Students will be introduced to the chemistry, atomic structure and the periodic table of elements. The course project and workbook are designed to help the students develop knowledge, problem-solving skills and critical thinking.
Class Format	Lecture, Discussion
Please Note !	Students are expected to attend all classes and arrive on time. Absences and lateness will be recorded. In cases of unavoidable absences, students are required to reach out to the instructor in advance. Missed assignments and exams may result in lower grades or penalties.

Course Map			
Semester 1	Contents and Method of Course	Goals	Science1(GA)
1st ~ 7th week	Life Science 1 and Earth Science 1		
8th week	Wrap-up of first half of semester	To review and summarize the learning contents of the class presented in the first half of the semester.	
9th week	Midterm Examination	Evaluation of students' comprehension	
10th week	Return of examination solve and reflection	To review students' results and the test items score	
11th week	**1. Introduction to Chemistry**		
	1.1. Why is learn chemistry Solution	1. Describe the importance of chemistry in our daily life.	
		2. Understand the relationship between chemistry and daily life.	
	1.2. Classification of matter	1. Describe the differences between elements, compounds and mixtures.	
	1.3. Physical and chemical properties of matter	1. Classify the components of matter in terms of physical and chemical properties.	
	1.4. Measurements and separation methods	1. Write the names and symbols for the first 20 elements in the periodic table. 2. Write the equation for density, mass, temperature, and volume. 3. Write a scientific number in standard form and write the same number in decimal form. 4. Convert between Celsius and Kelvin temperature scales. 5. Name appropriate measuring devices for measurement of mass, volume, and temperature, and explain how each is used. 6. Use dimensional analysis to solve problems involving conversions between different units of measurement. 7. Determine the number of significant figures in measurements and calculated quantities. 8. Round calculated answers to the correct number of significant figures. 9. Express numbers in scientific notation and perform calculations with the given numbers of significant figures. 10. Use dimensional analysis to convert between two different units of measurement. 11. Use dimensional analysis to convert between two different units of measurement.	
12th week	**2. Atomic structure and the Periodic table of elements**		
	2.1. Atomic theories	1. Understand and explain the development of atomic theories. 2. Explain the results of Thomson's cathode ray experiment. 3. Explain the results of Rutherford's gold foil experiment.	
	2.2. Atomic structure	1. Understand that atoms are composed of subatomic particles including electrons, protons, and neutrons and understand the properties of each subatomic particle and its location in the atom.	
	2.3. Atomic number, mass number, Isotope	1. Identify and describe the location of the subatomic particles in the atom in terms of their charge, relative mass, and relative charge. 2. Identify the atomic number and atomic number of an element. 3. Describe the distribution of electrons in an atom. 4. Given an atom's atomic number, determine the number of protons, neutrons and electrons in the atom's nucleus and the atom's atomic or proton number. 5. Given an atom's mass number and atomic number: a. Write the symbol for the isotope. b. Write the name of the isotope. c. Determine the number of protons, neutrons, and electrons in the atom. 6. Understand that isotopes are atoms of the same element that have different numbers of neutrons. 7. Understand that the mass number is the sum of the number of protons and neutrons in the nucleus. 8. Identify isotopes when given the mass or number, and/or the atomic number of the element. a. Explain why isotopes of an element have the same atomic number. b. State that isotopes of an element have different mass numbers. c. Explain why isotopes of an element have different atomic masses. d. Compare and contrast atomic mass and mass number of an element. e. Explain why isotopes of an element have different atomic masses.	
	2.4. Electron configurations	1. Understand and explain the shells (or energy levels), subshells, and orbitals that make up an atom and describe the location of electrons in each. 2. Understand the number of electrons that can occupy each shell and subshell. 3. Describe the order of filling of electrons into the shells and subshells of an atom. 4. Write the electron configuration for an atom of any element. 5. Describe the order of filling of electrons into the shells and subshells of an atom. 6. Write the electron configuration for an atom of any element. 7. Explain the difference between the ground state and excited state of an atom. 8. Explain how the electron configuration of an atom is related to the position of the element in the Periodic Table.	
13th week	2.5. Periodic Table and trends	1. Describe the Periodic Table as an arrangement of elements in rows (periods) and in order of increasing atomic number. 2. Describe the Periodic Table as a way to organize elements with similar properties into columns (groups). 3. Describe how the Periodic Table is arranged into blocks (s, p, d, f) based on the subshell that each element's valence electrons occupy. 4. Explain why elements in the same group have similar chemical properties. 5. Explain how the position of an element in the Periodic Table can be used to predict its chemical properties. 6. Explain how the Periodic Table can be used to predict the number of valence electrons in an atom of an element. 7. Explain how the Periodic Table can be used to predict the relative sizes of atoms. 8. Explain how the Periodic Table can be used to predict the relative ionization energies of atoms. 9. Explain how the Periodic Table can be used to predict the relative electronegativities of atoms. 10. Explain how the Periodic Table can be used to predict the relative reactivities of atoms. 11. Explain how the Periodic Table can be used to predict the relative stabilities of ions. 12. Explain how the Periodic Table can be used to predict the relative sizes of ions. 13. Explain how the Periodic Table can be used to predict the relative ionization energies of ions. 14. Explain how the Periodic Table can be used to predict the relative electronegativities of ions. 15. Explain how the Periodic Table can be used to predict the relative reactivities of ions. 16. Explain how the Periodic Table can be used to predict the relative stabilities of ions. 17. Explain how the Periodic Table can be used to predict the relative sizes of ions. 18. Explain how the Periodic Table can be used to predict the relative ionization energies of ions. 19. 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14th week	**3. Chemical Bonding**		
	3.1. Lewis dot symbol	1. Write Lewis symbols for atoms and ions.	
	3.2. Ionic bonding	1. Describe the formation of positive ions known as cations by the loss of electrons. 2. Explain why the formation of cations is endothermic. 3. Describe the formation of negative ions known as anions by the gain of electrons. 4. Explain why the formation of anions is exothermic. 5. Explain why the arrangement of alternating cations and anions in a crystal lattice is energetically favorable. 6. Describe the formation of ionic bonds between elements of low ionization energy and elements of high electron affinity. 7. Explain why ionic compounds are solids at room temperature. 8. Describe the formation of ionic bonds between elements of low ionization energy and polyatomic ions. 9. Explain why ionic compounds are solids at room temperature. 10. Explain why ionic compounds are solids at room temperature.	
15th ~ 17th week	3.3 Metallic bonding	1. Define metallic bonding terms and explain the electrostatic interaction between positive metal ions and delocalized electrons. 2. Explain how the structure and bonding in metals gives rise to their characteristic physical properties.	
	3.4. Covalent bonding	1. Understand and explain the bonding between atoms in terms of the electrostatic interaction between two atoms leading to a lowering of potential energy. 2. Understand and explain the concept of bond length. 3. Understand how to calculate the energy change associated with bond formation and bond breaking. 4. Understand and explain the concept of bond energy. 5. Describe the formation of covalent bonds between two atoms. 6. Describe the formation of covalent bonds between two atoms in terms of the overlap of atomic orbitals. 7. Describe the formation of covalent bonds between two atoms in terms of the sharing of electrons in atomic orbitals. 8. Describe the formation of covalent bonds between two atoms in terms of the attraction of the shared electrons to the nuclei of the two atoms. 9. Describe the formation of covalent bonds between two atoms in terms of the electrostatic interaction between the shared electrons and the nuclei of the two atoms. 10. Describe the formation of covalent bonds between two atoms in terms of the potential energy of the system. 11. Describe the formation of covalent bonds between two atoms in terms of the kinetic energy of the system. 12. Describe the formation of covalent bonds between two atoms in terms of the total energy of the system. 13. Describe the formation of covalent bonds between two atoms in terms of the stability of the system. 14. Describe the formation of covalent bonds between two atoms in terms of the strength of the bond. 15. Describe the formation of covalent bonds between two atoms in terms of the length of the bond. 16. Describe the formation of covalent bonds between two atoms in terms of the angle between the bonds. 17. Describe the formation of covalent bonds between two atoms in terms of the dihedral angle between the bonds. 18. Predict the shapes of molecules and polyatomic ions with single bonds using valence shell electron pair repulsion (VSEPR) theory.	
18th week	3.5. Intermolecular forces	1. Describe hydrogen bonding between two molecules of the same compound containing O-H or N-H groups, including the role of lone pairs. 2. Explain why hydrogen bonding between molecules of the same compound causes the boiling points of molecular compounds to be higher than those of similar compounds that do not exhibit hydrogen bonding. 3. Explain why hydrogen bonding between molecules of the same compound causes the melting points of molecular compounds to be higher than those of similar compounds that do not exhibit hydrogen bonding. 4. Explain why hydrogen bonding between molecules of the same compound causes the solubility of molecular compounds in water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 5. Describe the bonding between water molecules. 6. Explain why hydrogen bonding between water molecules causes the boiling point of water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 7. Explain why hydrogen bonding between water molecules causes the melting point of water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 8. Explain why hydrogen bonding between water molecules causes the solubility of water in water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 9. Describe the bonding between water molecules and other molecules containing O-H or N-H groups, including the role of lone pairs. 10. Explain why hydrogen bonding between water molecules and other molecules containing O-H or N-H groups causes the boiling points of these compounds to be higher than those of similar compounds that do not exhibit hydrogen bonding. 11. Explain why hydrogen bonding between water molecules and other molecules containing O-H or N-H groups causes the melting points of these compounds to be higher than those of similar compounds that do not exhibit hydrogen bonding. 12. Explain why hydrogen bonding between water molecules and other molecules containing O-H or N-H groups causes the solubility of these compounds in water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 13. Describe the bonding between water molecules and ions. 14. Explain why hydrogen bonding between water molecules and ions causes the solubility of ionic compounds in water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 15. Explain why hydrogen bonding between water molecules and ions causes the solubility of ionic compounds in water to be higher than those of similar compounds that do not exhibit hydrogen bonding. 16. 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19th week	Final Examination	Evaluation of students' comprehension	
20th week	Return of examination solve and reflection	Review students' results and the test items score for the final exam	

	Examination	Presentation	Workshop	Mini	Quiz	Misc
Basic ratio						
Criteria						
Ratio of subjects for evaluation	50%	20%	30%			
			Total	100%		