# Science 6 (Chemistry)

**Basic Course Information**

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| **Course Number** | 03009324 | **Subject Category** | Compulsory(G) |
| **Class Format** | Lecture | **Credit Type and Number of Credits** | 1.5 |
| **Department** | Mechatronics | **Student Category** | Year 3 |
| **Period of Study** | Semester 2 | **Classes per Week** | 3 |
| **Required Materials** | 1. Burdge, J. Driesser, M. (2017). Introductory Chemistry: AN ATOMS FIRST APPROACH. McGraw-Hill Education<br>2. Chang, R., Overby, J. (2019). Chemistry (13th ed). McGraw-Hill Education. | | |
| **Instructor** | Dr. Thitipat Chongcharoensiri | Dr. Tanchai Chooppawa | |

**Course Objective**

Science 6 is the final chemistry course and aim to learn about the link between chemistry and society/engineering, based on the basic knowledge learnt in Chemistry 1 to 4.

Organic chemistry and Inorganic chemistry are basic knowledge in many field including engineering field that require a good knowledge and application of chemistry. This course provides students with basic knowledge concepts of Organic chemistry consisting of hydrocarbon compounds and heteroatom compounds. For Inorganic chemistry, providing concepts about metal elements, their properties and applications.

Students are expected to develop an appreciation of the fundamental laws and principles and their applications to solve typical problems.

This course also tries to develop students' human skills, such as thinking, explaining, discussing, and collaborating skills, through solo and group works that are key competencies for global engineers to crest something new.

| **Evaluation/Rubric** | Ideal Level of Achievement (Very Good) | Standard Level of Achievement (Good) | Unacceptable Level of Achievement (Fail) |
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| Understanding of Organic chemistry & Metal - Transition metal elements | 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 Organic chemistry & Metal - Transition metal elements | Ability to correctly explain the contents. | | |
| Mathematical and graphical representation | Equations show good understanding and graphs are logical with sufficient details. | Equations show understanding and graphs are reasonable with reasonable with inaccuracies. | Equations are limited or incorrect. Graphs are incomplete or absent. |

**Relationship with Learning Outcomes**

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| **G(1) Wide knowledge on Science and Engineering and practical ability to apply them to solve problems in** |
| **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** |

**Teaching Method**

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| **Outline:** | Students learn basic concepts and principles of Organic chemistry and Inorganic chemistry<br>The worksheet, workbook and presentrators 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 recommended to keep photo copies or files of all submitted material to ensure further study by oneself/em. |

| **Course Plan:** | | | |
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| **Semester 2** | **Contents and Method of Course** | **Goals** | **Related MCC** |
| | **1. Metals and transition metals** | | |
| 1st week | 1.1. Alkali, alkaline earth metals and aluminium | 1) Compare the general physical properties of metals and non-metals.<br>2) Describe the general chemical properties of metals.<br>3) Describe the Group I elements and explain general trends down the group and predict the properties of other elements in Group I.<br>4) Describe, and make predictions from, the general trends in the chemical properties of the elements in Group II.<br>5) State the order of the reactivity series. | 1-C 1 20<br>1-C 1 21<br>1-C 1 26<br>1-C 1 28<br>1-C 1 47<br>2-C 1 48 |
| 2nd week | 1.2. Properties of transition metals | 1) Describe the properties of transition elements.<br>2) Describe the periodic trends in radii and oxidation states of the transition metal ions, including the origin and effect of the lanthanide contraction. | 1-C 1 20<br>1-C 1 21<br>1-C 1 26<br>1-C 1 28 |
| 3rd week | 1.3. Coordination compounds | 1) Define coordination compound.<br>2) Identify the coordination number of a coordination complex.<br>3) Name coordination compounds given their formula and write their formula given their name. | E-C 3 10<br>E-C 3 11<br>E-C 3 12<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 4th week | 1.4. Geometry and bonding of coordination compounds | 1) Define isomerism and differentiate between the various types of isomers.<br>2) Recognize and draw the geometric isomers of a complex.<br>3) Recognize and draw the optical isomers of a complex. | E-C 3 10<br>E-C 3 11<br>E-C 3 12<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 5th week | 1.5. Crystal field theory and application of coordination compounds | 1) Apply concepts of crystal field theory to explain properties of coordination compounds such as color and magnetic properties.<br>2) Discuss the nature of ligand exchange reactions including an explanation of kinetic lability.<br>3) Provide examples of common applications of coordination compounds. | E-C 3 10<br>E-C 3 11<br>E-C 3 12<br>E-C 3 15<br>E-F 6 14<br>E-F 6 16 |
| 6th week | 1.6. Sources of metallic elements and metallurgy | 1) Describe the ease in obtaining metals from their ores, related to the position of the metal in the reactivity series.<br>2) Describe the extraction of metals. | E-C 3 10<br>E-C 3 12<br>E-O 4 9<br>E-O 4 10<br>E-F 6 16 |
| 7th week | 1.7. Applications of metals | 1) Describe the uses of metals in terms of their physical properties.<br>2) Explain in terms of structure how alloys can be harder and stronger than the pure metals.<br>3) Explain how different sized atoms in alloys mean the layers can no longer slide over each other.<br>3) Describe the uses of alloys in terms of their physical properties. | E-C 3 10<br>E-C 3 11<br>E-C 3 15<br>E-O 4 9<br>E-O 4 10<br>E-F 6 16 |
| 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 | |
| | **2. Organic chemistry** | | |
| 11th week | 2.1. Introduction of hybridization and hydrocarbon compounds | 1) Determine the hybridization of atoms in molecules based on observed molecular geometry.<br>2) Define the term hydrocarbon as a compound made up of C and H atoms only.<br>3) Interpret and use the general, structural, displayed and skeletal formulae of hydrocarbons.<br>4) Name the hydrocarbons based on IUPAC naming method.<br>5) Describe the physical and chemical properties of hydrocarbons.<br>6) Describe the preparation and testing of hydrocarbons. | E-C 3 10<br>E-C 3 11<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 12th week | 2.2. Aromatic hydrocarbons | 1) Interpret and use the general, structural, displayed and skeletal formulae of aromatic hydrocarbons.<br>2) Naming the aromatic hydrocarbons based on IUPAC naming method.<br>3) Describe the physical and chemical properties of aromatic hydrocarbons.<br>4) Describe the preparation and testing of aromatic hydrocarbons. | E-C 3 10<br>E-C 3 11<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 13th - 14th week | 2.3. Hydrocarbon derivatives | 1) Interpret and use the general, structural, displayed and skeletal formulae of hydrocarbons derivatives.<br>2) Identify a functional group of hydrocarbons derivatives.<br>3) Name the hydrocarbons derivatives based on IUPAC naming method.<br>4) Describe the physical and chemical properties of hydrocarbons derivatives.<br>5. Describe the | E-C 3 10<br>E-C 3 11<br>E-C 3 12<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 15th - 16th week | 2.4. Isomerism | 1) Describe structural isomerism and its division into chain, positional and functional group isomerism.<br>2) Describe stereoisomerism and its division into geometrical 'cis/trans' and optical isomerism.<br>3) Explain what is meant by a chiral center and that such a center gives rise to optical isomerism.<br>4) Identify chiral centers and geometrical 'cis/trans' isomerism in a molecule of given structural formula.<br>5) Deduce the possible isomers for an organic molecule of known molecular formula. | E-C 3 10<br>E-C 3 11<br>E-C 3 12<br>E-C 3 15<br>E-O 4 7<br>E-O 4 8 |
| 17th - 18th week | 2.5. Synthesis and properties of polymers and biomolecules | 1) Describe the synthesis and properties of polymers.<br>2) Predict the type of polymerization reaction for a given monomer or pair of monomers.<br>3) Recognize the useful of biodegradable polymers.<br>4) Identify organic functional groups of biomolecules using the reactions and predict the properties and reactions of biomolecules. | E-C 3 10<br>E-C 3 11<br>E-C 3 15<br>E-O 4 9<br>E-O 4 10<br>E-F 6 16 |
| 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

| | **Examination** | **Presentation** | **Worksheet** | **Behavior** | **Portfolio** | **Other** |
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| Basic Ability | 50 | 0 | 15 | 0 | 0 | 0 |
| Technical Ability | 30 | 10 | 0 | 0 | 0 | 0 |
| Interdisciplinary Ability | 20 | 10 | 0 | 0 | 0 | 0 |

| | **Physics** | **Chemistry** | **Life Science** | **Earth Science** |
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| Ratio of subjects for evaluation | 0% | 100% | 0% | 0% |
| Science subject | | | | |