

Course syllabus (ประมวลรายวิชา)

Subject Code	SCI 33224
Subject	Chemistry 4
Credit	1.5 units
Learning Standards	SCIENCE
Teacher	Ms.GenÇ Chonthicha
School	The Demonstration School of Suan Sunandha Rajabhat University (English Program: Secondary Section)
Semester	1 st Semester
Academic Year	2018 (B.E. 2561)
Educational Levels	Upper Secondary Education Level (Upper secondary education grades 4-6, also known as grades 10-12)
Grade Level	Grade 12 (Matthayom 6)
Curriculum	The Basic Education Core Curriculum 2001 (B.E. 2551) was announced by The Ministry of Education.
Learning Time	3 hrs/ week
Total Learning Time	60 hrs

Learners' Quality**Grade 12 graduates**

- Understand maintenance of cell equilibrium and mechanisms for maintaining equilibrium of living things
- Understand processes of genetic transmission, variation, mutation, evolution of living things and factors affecting their survival in various environments
- Understand processes, importance and effects of biotechnology on human beings, living things and the environment
- Understand kinds of important particles that form components of atomic structures, sequencing of elements in the Periodic Table, chemical reactions and writing chemical equations, and factors affecting rates of chemical reaction
- Understand kinds of binding forces between particles and various properties of substances that are related to binding forces
- Understand the origin of petroleum, natural gas separation and fractional distillation of crude oil, the application of petroleum products for useful purposes and their effects on living things and the environment

- Understand kinds, properties and important reactions of polymers and biomolecular substances
- Understand relationships between quantities involving various types of motion; properties of mechanical waves; quantities of sound and hearing; properties, benefits and harms of electromagnetic waves, radioactivity and nuclear energy.
- Understand change processes of the Earth and geological phenomena affecting living things and the environment
- Understand origin and evolution of the solar system, galaxies, the universe, and the importance of space technology
- Understand how scientific knowledge can result in development of various kinds of technologies, and how technological development can result in discovery of advanced scientific knowledge, as well as the effects of technology on life, society and the environment
- Identify problems; pose questions for investigation and verification by prescribing relationships between various variables; search for data from various sources; propose several possible hypotheses; decide to investigate feasible hypotheses
- Plan processes of investigation and verification for problem-solving or answering questions; analyse and link relationships of various variables by applying mathematical equations or creating models from results or knowledge obtained from investigation and verification
- Communicate thoughts and knowledge obtained from investigation through verbal or written presentation, display or application of information technology
- Explain scientific knowledge and apply scientific processes for living and seeking additional knowledge; create projects or work pieces in accord with their interests
- Show interest, dedication, responsibility, care and honesty in investigating and seeking knowledge by applying instruments and methods that yield accurate and reliable results
- Are aware of the value of scientific and technological knowledge applied in daily life and livelihood; show appreciation, pride, respect, and make references to achievements and accomplishments resulting from local wisdom and development of modern technology
- Show recognition, care and concern as well as appreciative behaviour for utilization and conservation of natural resources and the environment; volunteer to cooperate with the community for protection and care for natural resources and local environment
- Show satisfaction and appreciation of abilities to discover knowledge, find answers or solve problems
- Work constructively with others; express opinions based on reliable references and sound reasoning resulting from scientific and technological development and application,

bearing in mind moral obligation to society and the environment; and be ready to acknowledge views of others

Chemistry: Grade 12

Electrochemistry (21periods)

Unit outcomes: Students will be able to:

- Understand the fundamental concepts related to oxidation- reduction reaction;
- Know the application of redox reactions in production of new substances and energy;
- Demonstrate an understanding of fundamental concepts related to the interconversion of chemical & electrical energy;
- Understand the difference between metallic conduction & electrolytic conduction;
- Identify & describe the functioning of the components of electrolytic & galvanic cells;
- Understand the difference between electrolytic & galvanic cells;
- Know how to solve problems based on Faraday's law;
- Measure through experimentation the mass of metal deposited by electroplating (e.g.:- copper from copper(II) sulphate), & apply Faraday's law to relate the mass of metal deposited to the amount of charge passed;
- Predict the spontaneity of redox reactions & overall cell potentials by studying a table of half-cell reduction potentials;
- Determine the emf of an electrochemical cell experimentally or from given data;
- Explain the application of electrochemistry in our daily lives & in industry;
- Explain corrosion as an electrochemical process, & describe corrosion- inhibiting techniques (e.g. painting, galvanizing, cathodic protection);
- Describe examples of common galvanic cells & evaluate their environmental & social impact;
- Describe scientific enquiry skills along this unit: observing, classifying, comparing & contrasting, communicating, asking question, measuring, relating cause & effect and problem solving.

Competencies	Contents	Suggested Activities
<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> define redox reaction define oxidation in terms of electron transfer and change in oxidation number. define reduction in terms of electron transfer and change in oxidation number. describe the oxidizing and reducing agents identify the species that are oxidized and reduced in a given redox reaction and determine the oxidizing and reducing agents 	<p>1. Electrochemistry 4.1. Reduction-oxidation reactions (5 periods)</p> <ul style="list-style-type: none"> Oxidation Reduction 	<p>Since Redox Reactions play important role in all areas of chemistry especially Biological sciences, students should be encouraged to think of chemical reactions of relevance to plant and animal physiology.</p> <p>Remind students about rules to assign oxidation numbers. Let them understand the terminologies like redox reaction, oxidation, reduction half-reaction, oxidizing agent and reducing agent.</p> <p>Ask students to identify the oxidized and reduced species and, the oxidizing and reducing agents.</p> <p>To help students the concept that an oxidizing agent it self reduced, you can discuss the action of a bleaching agent on clothing in a washing machine. A bleaching agent, which causes a whitening to occur, does not itself become whiter. An oxidizing agent is not oxidized.</p>
Competencies	Contents	Suggested Activities
<ul style="list-style-type: none"> balance a given redox reaction using oxidation number method balance a given redox reaction using ion-electron method Recall metallic conductivity, electrolytic conductivity and electrolysis of molten electrolytes. draw labeled diagrams of an electrolytic cell; define preferential discharge explain factors that affect preferential discharge. describe the effect of nature of the ions on the electrolysis of aqueous solutions of dil. H_2SO_4 and NaOH. describe the effect of concentration of the ions on the electrolysis of dilute and concentrated solutions of NaCl 	<ul style="list-style-type: none"> Balancing redox reactions <ul style="list-style-type: none"> - Change in Oxidation number method - Ion-electron method 4.2 Electrolysis of Aqueous Solutions (6 periods) <ul style="list-style-type: none"> Electrolytic cell Preferential discharge Electrolysis of some selected aqueous solutions 	<p>Students should be guided step by step on how to use the Change in Oxidation Number method and Ion-Electron method to balance equations where the simpler methods do not help.</p> <p>It is important to point out to students that oxidation numbers used in balancing redox equations are arbitrary values obtained by using arbitrary rules.</p> <p>Students should be warned against thinking that the oxidation number represents the real ion charge in the molecule.</p> <p>Students could discuss the metallic and electrolytic conductivities and electrolysis of molten electrolytes.</p> <p>All chemical changes, including electrochemical ones, involve energy changes. The main focus of this unit is to show how redox reactions can be caused to occur by the action of electricity, and the way electricity can be obtained from redox reactions that occur spontaneously.</p> <p>Students should appreciate the processes that take place at the cathode and anode in an electrolytic cell. The terminologies-cathode, cation, anode and anion are easily confused by students. Students should discuss in groups until they have them right.</p> <p>Students should learn from examples to be given how the net reaction in the electrolysis of aqueous solutions is controlled by which redox reactions occur most easily.</p> <p>Students should be asked to draw and label electrolytic cells. They should also show at which electrodes reduction and oxidation reactions take place.</p> <p>Students should know that the electrode can discharge only one type of species in preference to the other at a time</p> <p>Students should be able to confirm that electrons lost during oxidation half reaction are equal to electrons gained during reduction. The net reaction in a cell is the sum of cathode (reduction) and anode (oxidation) half reactions. Here the connection to the ion-electron method of balancing equations.</p> <p>Students should be assisted to conduct experiments on electrolysis of aqueous solutions and confirm the effects of different factors on preferential discharge of ions. They should write the anode, cathode and overall reactions name the product for each types of activities.</p>

Competencies	Contents	Suggested Activities
<ul style="list-style-type: none"> mention industrial applications of electrochemistry, explain electroplating and electro refining, demonstrate copper refining, explain how electrolysis is used in the production of some metals, nonmetals and compounds, 	<p>4.4 Industrial Application of Electrolysis (2 periods)</p> <ul style="list-style-type: none"> Electroplating and Electro refining Extraction of metals Manufacturer of Non-metals and some compounds <p>4.5 Voltaic Cells (5 periods)</p> <ul style="list-style-type: none"> Construction of Zn - Cu voltaic cell Cell diagram (Notation for Voltaic cell) Electromotive Force Measuring standard electrode potentials 	<p>Electrolysis has wide applications. Students should be asked to list down some of them in class. They should also be asked to explain to class how they are related to electrolysis. Let the students conduct an experiment on refining of copper. When they discuss electroplating they should know which electrode is the metal to be plated and vice versa. Ask students which elements are extracted from their ores only through electrolysis and why.</p> <p>Students should know that voltaic cells have important roles to play in society. The cells are divided into primary and secondary. Students have to be careful when handling such devices. Ask the students to write chemical equations for the reactions they think take place. They should be able to identify the various components of the cells. Ask students to draw diagrams of the various types of voltaic cells.</p> <p>Students should construct a simple galvanic cell (Daniel's cell). They should identify the parts and measure the cell potential.</p> <p>They should also measure potentials of half-cell using standard half-cells. Finally students can make their own EMS of given elements.</p>
Competencies	Contents	Suggested Activities
<ul style="list-style-type: none"> calculate cell potential decide whether a given redox reaction is spontaneous or not. explain the effect of concentration on cell potential Mention the different types of voltaic cells give examples of each type of voltaic cell describe how Hydrogen-Oxygen Fuel cell operates distinguish between primary and secondary cells identify the cathode, anode, and the electrolyte of a given voltaic cell, compare and contrast electrolytic and voltaic cells explain metallic corrosion in terms of redox reaction explain the negative effects of corrosion, explain the different methods of prevention of corrosion 	<ul style="list-style-type: none"> Calculation of cell potential Dependence of emf on concentration. Types of voltaic cells, Corrosion of metals. 	<p>Students should exercise calculating the cell potential and decide the spontaneity of the reactions. Assign students to collect and bring used and disposed batteries and ask them to identify their types. Students have to be careful when handling such devices.</p> <p>Students should understand how hydrogen-oxygen fuel cell operates. Students should be able to tell the differences between primary, secondary and fuel cells.</p> <p>Help students design experiments that will help them identify the factors responsible for corrosion of metals. Can the students see that this is a spontaneous reaction. Would we have to worry if it was a non-spontaneous reaction?</p>

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the Competencies, to determine whether the student has achieved the minimum required level. Students at minimum requirement level

Students working at the minimum requirement level will be able to: define redox reaction, oxidation and reduction; identify the species that are oxidized and reduced in a given redox reaction, and describe the oxidizing and reducing agents; balance a given redox reaction using oxidation number method and ion-electron method; distinguish between molten electrolytes and aqueous electrolytic solutions; draw labeled diagrams of an electrolytic cell; define preferential discharge and explain factors that affect it; describe the reactivity of a metal from its position in the activity series or electro motive series; describe the effect of nature of the ions on the electrolysis of aqueous solutions of dil. H_2SO_4 and NaOH ; describe the effect of concentration of the ions on the electrolysis of dilute and concentrated solutions of NaCl ; describe the effects of types of electrodes on the electrolysis of CuSO_4 solution using Ni electrodes and Cu electrodes; write electrode half reactions and overall reactions for the electrolysis of dil. H_2SO_4 , NaOH , dil NaCl , conc. NaCl and CuSO_4 solutions; state Faraday's first law of electrolysis , write its mathematical expression and do calculations related to it; state Faraday's second law of electrolysis, write its mathematical expression and do calculations related to it; mention industrial applications of electrochemistry; explain electroplating and electro refining;

explain how electrolysis is used in the production of some metals, nonmetals and compounds; define voltaic cell , salt bridge , electrode potential and cell potential; draw , label and construct $\text{Zn} - \text{Cu}$ voltaic cell; measure the cell potential of $\text{Zn} - \text{Cu}$ cell using voltmeter; explain how standard electrode potential is measured and calculate it from the given information; decide whether a given redox reaction is spontaneous or not; explain the effect of concentration on cell potential; mention different types of voltaic cells and give examples of each type of them; distinguish between primary and secondary cells; describe how Hydrogen-Oxygen Fuel cell operates; identify the cathode, anode, and the electrolyte of a given voltaic cell; compare and contrast electrolytic and voltaic cells; explain metallic corrosion in terms of redox reaction and the negative effects of corrosion; explain the different methods of prevention of corrosion.

Students above minimum requirement level

Students working above the minimum requirement level should be praised and their achievements recognized. They should be encouraged to continue working hard and not become complacent.

Students below minimum requirement level

Students working below the minimum requirement level will require extra help if they are to catch up with the rest of the class. They should be given extra attention in class and additional lesson time during breaks or at the end of the day.

Some Elements in Nature and Industry (17 periods)

Unit outcomes: Students will be able to:

- Describe occurrence and abundance of the elements in nature;
- Explain how carbon, nitrogen and phosphorus cycle in nature;
- Understand the metallurgical processes;
- Understand the occurrence, extraction & chemical properties of Sodium, Calcium, Tin, Lead, Zinc & Chromium; • Explain the steps in industrial production of ammonia, nitric acid, sulfuric acid and Diammonium phosphate.
- Describe scientific enquiry skills along this unit: classifying, communicating, asking questions, relating cause & effect and making generalization.

Some Elements in Industry

5.2.1 Metallurgy

- Pretreating the ore
- Converting the mineral to the element
- Refining and alloying

5.2.2 Extraction, properties and uses of some selected metals

- Sodium - Extraction - Chemical properties - Uses
- Calcium - Extraction - Chemical properties - Uses
- Tin - Extraction - Chemical properties - Uses
- Lead - Extraction - Chemical properties - Uses
- Zinc - Extraction - Chemical properties - Uses
- Chromium - Extraction - Chemical properties - Uses

5.2.3. Silicon

- Production
- Chemical properties
- Uses

5.2.4. Some important compounds of selected nonmetals

- Ammonia
- Nitric acid
- Sulphuric acid
- Diammonium Phosphate (DAP)

****Project 20% this topic**

Assessment

The teacher should assess each student's work continuously over the whole unit and compare it with the following description, based on the Competencies, to determine whether the student has achieved the minimum required level.

Students at minimum requirement level

Students working at the minimum requirement level will be able to: define the terms mineral, ore and metallurgy; describe the forms of occurrences of metals; discuss the distribution and relative amounts of the elements in the earth's crust; define the term fixation; discuss the carbon cycle, the nitrogen cycle and the phosphorus cycle; explain the major steps in metallurgical processes; describe the manufacture of sodium, calcium, tin, lead, zinc and chromium; explain the chemical properties of sodium, calcium, tin, lead, zinc and chromium; describe the uses of sodium, calcium, tin, lead, zinc and chromium; explain the steps in Haber process, the industrial production of ammonia, the Ostwald's process, the industrial production of nitric acid, the contact process, industrial production of sulphuric acid, the industrial production of Diammonium Phosphate, and the industrial production of Silicates

Requirements

Learners are expected to:

- Complete all assignments.
- Participate and actively engage in discussions with fellow learners while contributing to the social construction of knowledge.
- Be self-directed and self-motivated.
- Ask for assistance when they need it.

Facilitators are expected to:

- Provide feedback to all learners.
- Participate in discussions to keep them moving forward.
- Provide assistance to learners who need it.

Course Activities

Course activities may include:

- Do experiment in Laboratory
- Watching linear and interactive animations and simulations
- Completing hands-on and virtual activities
- Participating in threaded discussions with teachers and fellow students in a section, cohort, or group
- Completing self-check exercises

Graded assignments may include:

- Online or paper-based worksheets and practice sets
- Quizzes
- Exams (unit, semester and final)
- Threaded discussions
- Essays, research papers, and other writing assignments
- Presentation

Student Evaluation (60:40)

Unit tests and Quizzes

15%

Activities, labs and field investigations	10%
Lecture/ Workbook	15%
Class participation, class work and case study	10%
One project / oral presentation	10%
Midterm exam	20%
Final exam	20%

Grading Scale:
















Grade	Percent
-------	---------

















4	=	100-80 percent
3.5	=	79-75 percent
3	=	74-70 percent
2.5	=	69-65 percent
2	=	64-60 percent
1.5	=	59-55 percent
1	=	54-50 percent
0	=	below 50 percent

Reference Textbooks

Pearson Secondary 6 : Elective Chemistry

Long Term Planning

Week	Date	Scope and Sequence of Lesson	Note
1.	15-22 May 18	 Orientation  1.Electrochemistry 4.1. Reduction-oxidation reactions (5 periods)	
2.	24-29 May 18	 • Oxidation  • Reduction	*Tue. 29 th May Visakha Bucha Day <u>*** lost 1 periods</u>
3.	31 May – 5 Jun 18	 4.2 Electrolysis of Aqueous Solutions (6 periods)  • Electrolytic cell	
4.	7 – 12 Jun 18	 • Preferential discharge  • Electrolysis of some selected aqueous solutions	
5.	14-19 Jun 18	 4.4 Industrial Application of Electrolysis (2 periods)  • Electroplating and Electro refining  • Extraction of metals  • Manufacturer of Nonmetals and some compounds 	
6.	21 – 26 Jun 18	 4.5 Voltaic Cells (5 periods)  • Construction of Zn - Cu voltaic cell	

Week	Date	Scope and Sequence of Lesson	Note
		 • Cell diagram (Notation for Voltaic cell)	
7.	28 Jun – 5 Jul 18	 • Electromotive Force  • Measuring standard electrode potentials	
8.	6 – 13 Jul 18	Midterm Test	
9.	16 – 20 Jul 18	 Calculation of cell potential  • Dependence of emf on concentration.	
10	23 – 26 Jul 18	 • Types of voltaic cells,  • Corrosion of metals.	Fri.27 th Jul Day off: Asarnha Bucha Day
11	31 Jul – 3 Aug 18	 5.2 Some Elements in Industry (12 periods)  5.2.1 Metallurgy  • Pretreating the ore	Mon.30 th Jul Day off: From 29 th Jul =Chalerm Prachonmapunsa the king Rama ๑๐ <u>*** lost 2 periods</u>
12	6 – 10 Aug 18	 • Converting the mineral to the element  • Refining and alloying	
13	14 – 17 Aug 18	 5.2.2 Extraction, properties and uses of some selected metals ***My mapping	Mon.13 th Aug Day off: From 12 th Aug =Mother's Day <u>*** lost 2 periods</u>
14	20-24 Aug 18	 Tutoring Organic Chemistry for PAT 2	
15	27 – 31 Aug 18	 Tutoring Organic Chemistry for PAT 2	
16	3 – 7 Sep 18	 Revision for Final Test	
17	10 – 17 Sep 18	Final Test	