Wah Yan College Kowloon
S.6 Chemistry Scheme of Work (2016-2017)

Textbook	1. New 21st Century Chemistry 6 Topic 14 Industrial Chemistry (Elective Part) (1st Edition) (WY) 2. New 21st Century Chemistry 8 Topic 16 Analytical Chemistry (Elective Part) (1st Edition) (WY)
Other Resources	

SL: Scheduled number of lessons
AL: Actual number of lessons

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
First Term (1/9/2016-2/1/2017)			**Topic 14 Industrial Chemistry**				
			Unit 45 An introduction to industrial chemitry				
	1	SL	45.1 What is chemical industry?	• Chemical industry converts raw materials into products of greater value to us	• PowerPoint • Discussion	I,II	
	1	SL	45.2 Products from the chemical industry	• Five categories of products from the chemical industry	• PowerPoint • Discussion	I,II,III	
	1	SL	45.3 The operation of a chemical process in industry*	• Feedstocks • Batch and continuous operations	• PowerPoint	I,II	
	1	SL	45.4 Petrochemical industry	• China's petrochemical industry • Sustainable development	• PowerPoint • Discussion	II	
	1	SL	45.5 Production of vitamin C*	• Comparing two processes of producing vitamin C	• PowerPoint	II	
	2	SL	45.6 The use of catalysts	• Why bother with reaction	• PowerPoint	II	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				kinetics?	• Discussion		
	2	SL	45.7 The effect of change in concentration on the rate of a reaction	• Rate equation • Rate constant	• PowerPoint	II,IV	
	2	SL	45.8 Order of reaction	• Overall order of reaction • Zero, first and second order reactions • Rate-concentration graphs • Concentration-time graphs	• PowerPoint	I,II	
	2	SL	45.9 Units of rate constant *k* for reactions of different order	• Units of rate constant *k* for zero, first and second order reactions	• PowerPoint	I,II	• Checkpoint
	2	SL	45.10 Experimental determination of the rate equation for a reaction — the method of initial rate	• Determining initial rates from different concentration-time curves • Using the reciprocal of the time required to produce a small amount of a product as a measure of the initial rate	• PowerPoint • Activity 45.1 — Determining the rate equation for the reaction between sodium thiosulphate solution and dilute sulphuric acid using a microscale chemistry experiment	I,II	
	3	SL	45.11 Using the iodine	Using the iodine clock method to	• PowerPoint	I,II	• Checkpoint

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			clock method to determine the rate equation for a reaction	determine the rate equation for the reaction between peroxodisulphate ion and iodide ion	•Activity 45.2 — Determining the rate equation for the reaction between acidified propanone solution and iodine by colorimetry •Activity 45.3 — Determining the rate equation for an iodine clock reaction		• Unit exercise
			Unit 46 Factors affecting the rate of a reaction				
	3	SL	46.1 The effect of change in temperature on the rate of a reaction	• Illustrating the effect of temperature change on the rate of reaction using the reaction between dilute sulphuric acid and sodium thiosulphate solution	• PowerPoint	IV	
	3	SL	46.2 A further look at the collision theory	• Basic ideas of the collision theory • Energy profiles • Activation energy	• PowerPoint	I,II	• Checkpoint
	3	SL	46.3 The energy distribution curve	• Maxwell-Boltzmann distribution curve for the distribution of	• PowerPoint	I,II	• Checkpoint

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				molecular kinetic energy for a gas • Effect of increasing temperature on the energy distribution curve • Explaining the effect of temperature on the rate of reaction			
	4	SL	46.4 Rate equation and reaction mechanism*	• Energy profile for a reaction which takes place in more than one step • Linking the rate equation to the reaction mechanism	• PowerPoint	I	• Checkpoint
	4	SL	46.5 The Arrhenius equation	• Determining the activation energy for a reaction by using the Arrhenius equation	• PowerPoint • Activity 46.1 — Determining the activation energy for a reaction	I,II	• Checkpoint
	4	SL	46.6 Catalysts	• Positive and negative catalysts • Features of catalysts	• PowerPoint	I	
	4	SL	46.7 How does a catalyst work	• Energy profiles for an uncatalyzed reaction and catalyzed reactions • Homogeneous catalyst and heterogeneous catalyst	• PowerPoint • Activity 46.2 — Catalyzing the reaction between peroxodisulphate ion and iodide ion	III,V	• Checkpoint

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
	5	SL	46.8 Heterogeneous catalysis*	• Illustrating how a heterogeneous catalyst works by using a model for the reaction pathway for the formation of ammonia from nitrogen and hydrogen • Catalysts in catalytic converters • Catalyst poisoning	• PowerPoint		
	5	SL	46.9 Homogeneous catalysis*	• Illustrating how a homogeneous catalyst works by using the oxidation of iodide ion by peroxodisulphate ion	• PowerPoint	II,IV	
	5	SL	46.10 Enzyme catalysis	• Making ethanol by fermentation • Why are enzymes so popular in chemical industry?	• PowerPoint	II,IV	• Checkpoint • Unit exercise
			Unit 47 Industrial processes				
	5	SL	47.1 Building a chemical plant in a city	• Using a scenario of building a chemical manufacturing plant as an introduction to three industrial processes: – manufacture of nitrogenous fertilizers – manufacture of chlorine gas – manufacture of methanol	• PowerPoint	II	
	5	SL	47.2 What do plants need	• The nitrogen cycle	• PowerPoint	I,II	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			to grow properly?	• Three main nitrogen fixation processes	• Animations		
	6	SL	47.3 Nitrogenous fertilizers	• Straight N fertilizers and NPK compound fertilizers	• PowerPoint	I,III	
	6	SL	47.4 Ammonia — the key to nitrogenous fertilizers	• Feedstocks • Reaction conditions • Flow diagram for the Haber process	• PowerPoint	II,IV	
	6	SL	47.5 Obtaining an economic yield in the Haber process	• Temperature • Pressure • Reaction conditions most manufacturers use	• PowerPoint • Animations	I,III	
	6	SL	47.6 From ammonia to nitrogenous fertilizers	• Main stages in the manufacture of nitric acid from ammonia	• PowerPoint • Discussion	IV,V	
	6	SL	47.7 Working on large scale production of nitrogenous fertilizers*	• Storage of raw materials • Transport of materials • Transfer of heat • Separation • Process control	• PowerPoint	IV,V	
	6	SL	47.8 NPK compound fertilizers	• Flow plan for the manufacture of NPK compound fertilizers	• PowerPoint	I,II	
	6	SL	47.9 The pros and cons of fertilizers	• Agriculture — the key to poverty reduction • Environmental problems	• PowerPoint • Animations	I,II	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				associated with the use of fertilizers			
	7	SL	47.10 The chloro-alkali industry	• Common uses of hydrogen, chlorine and sodium hydroxide	• PowerPoint	I,II	
	7	SL	47.11 Manufacture of chlorine	• Mercury electrolytic cell • Diaphragm cell • Membrane cell	• PowerPoint • Animations • Discussion	I	
	7	SL	47.12 Uses of methanol	• Chemicals produced from methanol	• PowerPoint	II	
	7	SL	47.13 From natural gas to methanol	• Main stages in the manufacture of methanol from natural gas – syngas generation – methanol synthesis – crude methanol purification • Changes in the production process of methanol	• PowerPoint • Discussion	I,II,III	
	7	SL	47.14 Methanol — a green feedstock?	• Methanol from biomass • Methanol from carbon dioxide captured from flue gas	• PowerPoint	I,II,III	
	7	SL	47.15 Choosing a site for a chemical plant*	• Factors to consider when choosing a site for a chemical plant	• PowerPoint • Discussion	I,II	• Unit exercise
			Unit 48 Green chemistry				
	7	SL	48.1 Sustainable development and	• Meaning of sustainable development	• PowerPoint	I,III	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			green chemistry	• 12 principles of green chemistry			
	8	SL	48.2 Feedstocks from renewable resources	• Illustrating the use of feedstocks renewable resources by using an example of producing a polymer from corn	• PowerPoint	I,IV	
	8	SL	48.3 Atom economy	• What atom economy is • Calculations involving percentage atom economy • A greener pain reliever — ibuprofen	• PowerPoint	I,III	• Checkpoint
	8	SL	48.4 Energy efficiency	• Methods for making industrial processes more energy efficient	• PowerPoint	I,III,V	
	8	SL	48.5 Manufacture of acetic acid in industry	• Oxidation of naphtha or butane • The Monsanto process • The Cativa process	• PowerPoint • Discussion	I,III,V	
	8	SL	48.6 Green chemistry and the life cycle of a product	• Stages of the life cycle of a product • How green chemistry can facilitate environmental improvements in the life cycle of a product	• PowerPoint • Discussion	I,III,V	• Unit exercise
	9		First Term Assessment				
			Topic 16 Analytical Chemistry				
			Unit 54 Tests for				

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			functional groups; separation and purification of compounds				
	10	SL	54.1 Chemical tests for various functional groups in carbon compounds	• Functional groups of different homologous series	• PowerPoint	II	
	10	SL	54.2 Tests for the alkene functional group	• Bromine test • Treatment with acidified aqueous solution of potassium permanganate	• PowerPoint	I,III	
	10	SL	54.3 Tests for the alcohol functional group	• Oxidation by acidified aqueous solution of potassium dichromate • Iodoform test • Lucas reagent	• PowerPoint	II,IV	• Checkpoint
	10	SL	54.4 Tests for the aldehyde and ketone functional groups	• Treatment with 2,4-dinitrophenylhydrazine • Treatment with Tollens' reagent (silver mirror test) • Triiodomethane formation (Iodoform test)	• PowerPoint • Studying the reactions of an aldehyde and a ketone with some reagents	I,III	• Checkpoint
	10	SL	54.5 Tests for the carboxylic acid functional group	• Treatment with aqueous solution of sodium hydrogencarbonate • Ester formation	• PowerPoint	I,III	• Checkpoint

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
	11	SL	54.6 Identifying functional group(s) in an unknown sample in the laboratory	• Deducing the functional group(s) in a sample based on the observations of tests on the sample	• PowerPoint • Activity 54.2 — Identifying the functional groups in two unknown compounds	I,III	
	11	SL	54.7 Separation and purification of compounds	• Common separation and purification methods for a liquid product • Common separation and purification methods for a solid product	• PowerPoint	I,II	
	11	SL	54.8 Distillation	• Set-up for distillation • Water condenser • Air condenser	• PowerPoint	I,II	
	11	SL	54.9 Fractional distillation	• For separating a mixture of miscible liquids • Set-up for fractional distillation	• PowerPoint	I,II,III	
	11	SL	54.10 Liquid-liquid extraction	• Techniques for working with a separating funnel	• PowerPoint	I,II,III	
	11	SL	54.11 Re-crystallization	• Choosing a suitable solvent • Dissolving the crude solid product in the chosen solvent • Allowing crystals to form and collecting crystals by filtration	• PowerPoint	I,II,III	• Checkpoint

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				under reduced pressure			
	11	SL	54.12 Chromatography	• What a stationary phase is • What a mobile phase is	• PowerPoint	I,II,III	
	11	SL	54.13 Paper chromatography	• Working principle of paper chromatography • Identifying colourless components • The retention ratio R_f	• PowerPoint • Activity 54.3 — Using paper chromatography for the separation and identification of amino acids	I,II,III	• Checkpoint
	11	SL	54.14 Column chromatography	• Working principle of column chromatography •	• PowerPoint	I,II,III	
	11	SL	54.15 Thin layer chromatography	• Working principle of thin layer chromatography	• PowerPoint	III	
	11	SL	54.16 Tests for purity of a product	• Determining the melting point of a solid product Determining the boiling point of a liquid product	• PowerPoint	I,II	• Checkpoint • Unit exercise
			Unit 55 Quantitative methods of analysis				
	12	SL	55.1 Quantitative analysis*	• Gravimetric analysis • Volumetric analysis • Choosing an analytical method	• PowerPoint	II,III	
	12	SL	55.2 Steps of the precipitation method	• Filtering off the precipitate • Drying the precipitate	• PowerPoint	I,III,V	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			in gravimetric analysis*	• Calculating the percentage by mass of the species being analyzed in sample			
	12	SL	55.3 Possible major sources of error*	• Systematic error • Random error	• PowerPoint	I,III,V	
	12	SL	55.4 Gravimetric determination of phosphorus content in a sample of fertilizer*	• Procedure for preparing a phosphate precipitate using a known mass of fertilizer • Calculating the percentage by mass of phosphorus in the sample of fertilizer • Sources of error	• PowerPoint • Discussion • Activity 55.1 — Determining the phosphorus content in a sample of fertilizer	I,III,V	
	12	SL	55.5 Gravimetric determination of calcium content in a sample solution*	• Procedure for preparing a calcium precipitate using a known volume of sample solution • Calculating the percentage by mass of calcium ions in the sample	• PowerPoint • Discussion • Activity 55.2 — Determining the calcium content in a sample solution	I,II	• Checkpoint
	12	SL	55.6 Precipitation titrations in volumetric analysis	• Procedure for determining the concentration of chloride ions in sea water by precipitation titration • Calculating the concentration of chloride ions in a sample of sea	• PowerPoint • Discussion • Activity 55.3 — Determining the concentration of chloride ions in a sea water sample	I,II	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				water	by titration with a standard aqueous solution of silver nitrate		
	12	SL	55.7 Redox titrations in volumetric analysis	• What redox titration is	• PowerPoint	I,II,V	
	12	SL	55.8 Redox titrations involving an aqueous solution of potassium permanganate	• Standardization of aqueous solution of potassium permanganate	• PowerPoint	I,II	
	12	SL	55.9 Determining the iron content in commercial iron tablets	• Procedure for determining the iron content in commercial iron tablets by titration with standard aqueous solution of potassium permanganate	• PowerPoint • Activity 55.4 — Determining the percentage by mass of iron(II) sulphate in a brand of iron tablets	I,II,IV	
	12	SL	55.10 Analyzing the quality of water by determining its permanganate index	• What the permanganate index of water indicates • Procedure for determining the permanganate index of a water sample • Calculating the permanganate index of a water sample	• PowerPoint • Activity 55.5 — Determining the permanganate index of a water sample	II	• Checkpoint
	12	SL	55.11 Determining the	• Procedure for determining the	• PowerPoint	III	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			vitamin C content in a sample using a redox titration involving iodine	vitamin C content in a sample by titration with aqueous iodine solution • Calculating the vitamin C content in the sample			
	12	SL	55.12 Determining the concentration of sodium hypochlorite in a household bleach using an iodine / thiosulphate titration	• Procedure for determining the concentration of sodium hypochlorite in a bleach – reacting a known volume of sample with iodide ions to liberate iodine – titrating the iodine with a standard aqueous solution of sodium thiosulphate • Calculating the concentration of sodium hypochlorite in the bleach	• PowerPoint • Activity 55.6 — Determining the sodium hypochlorite content in a bleach	II,V	• Checkpoint • Unit exercise
			Unit 56 Instrumental analytical methods				
	12	SL	56.1 The use of instruments in analytical chemistry	• Some properties that are observed in the measurement process of analytical chemistry • Advantages of instrumental analytical methods over the traditional gravimetric and	• PowerPoint	I,III,V	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values[#]	Consolidation and Assessment
				volumetric analyses			
	13	SL	56.2 Electromagnetic radiation	• The electromagnetic spectrum • Wavelength range of visible light	• PowerPoint	I,II	
	13	SL	56.3 The interaction of radiation with matter	• Different kinds of behaviour that occur when a molecule absorbs energy	• PowerPoint	I,II	
	13	SL	56.4 Colorimetry	• Components of a colorimeter • Determining the concentration of the species being analyzed in a sample from a calibration curve	• PowerPoint	II	• Checkpoint
	13	SL	56.5 Infrared spectroscopy	• For determining the functional groups present in carbon compounds	• PowerPoint	II	
	13	SL	56.6 Basic features of an infrared spectrum	• Wavenumber recorded on an infrared spectrum • Absorption bands	• PowerPoint	I,II	
	13	SL	56.7 Characteristic absorption wavenumber ranges for different bonds in carbon compounds	• The wavenumber ranges at which some covalent bonds absorb infrared radiation	• PowerPoint • Animations	I,II	
	13	SL	56.8 Using infrared	• Regions in the infrared spectrum	• PowerPoint	I,III	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			spectrum in the identification of bonds (or functional groups) in carbon compounds	where typical absorptions occur • Characteristic infrared absorption wavenumber ranges for some covalent bonds (stretching mode of vibration)			
	13	SL	56.9 Interpreting infrared spectra	• Interpreting the infrared spectra of some carbon compounds – *cis*-but-2-ene – butan-1-ol – butanone – butanoic acid • – butan-1-amine	• PowerPoint	I,II	• Checkpoint
	13	SL	56.10 Mass spectrometry	• Basic components of a mass spectrometer • Uses of mass spectrometry	• PowerPoint	I,II	
	13	SL	56.11 Finding relative atomic masses and relative molecular masses from mass spectra	• How to find relative atomic masses and relative molecular masses from mass spectra Molecular ion peak	• PowerPoint	III	
	14	SL	56.12 Using fragmentation patterns to determine the structures of molecules of carbon	• Fragmentations that occur for the molecular ion of butane • Identifying the ions corresponding to the major peaks in the mass spectrum of	• PowerPoint	IV	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			compounds	butane			
	14	SL	56.13 Fragmentation patterns of alkanes	• Comparing the mass spectra of three alkanes with molecular formula C_5H_{12} – pentane – 2-methylbutane • – 2,2-dimethylpropane	• PowerPoint	I,II	
	14	SL	56.14 Fragmentation patterns of aromatic compounds	• Mass spectrum of methylbenzene • Fragmentations that occur for the molecular ion of methylbenzene	• PowerPoint	I,II	
	14	SL	56.15 Fragmentation patterns of aldehydes and ketones	• Mass spectrum of pentan-3-one • Fragmentations that occur for the molecular ion of pentan-3-one • Typical fragment ions produced in a mass spectrometer	• PowerPoint	I	
	14	SL	56.16 Differences in mass/charge ratio between peaks	• Some common differences in mass/charge ratio due to the loss of fragments	• PowerPoint	I,II	
	14	SL	56.17 Interpreting mass spectra	• Mass spectrum of ethanol Mass spectrum of benzoic acid	• PowerPoint	I	• Checkpoint • Unit exercise

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
			Unit 57 Contribution of analytical chemistry to our society				
	15	SL	57.1 Introduction	• Examples of use of analytical chemistry in different fields	• PowerPoint	III,V	
	15	SL	57.2 Food analysis	The important role of analytical chemistry in food analysis	• PowerPoint	II,IV	
	15	SL	57.3 Gas chromatography	• Basic components of a gas-liquid chromatograph • Qualitative and quantitative analyses • Applications of gas chromatography	• PowerPoint	II,IV	• Checkpoint
	15	SL	57.4 Carbon monoxide in the air	• Expressing the concentration of a gas pollutant in the air in ppm • Carbon monoxide in the air of Hong Kong	• PowerPoint	II,III	• Checkpoint
	15	SL	57.5 Dioxins in the air	• What dioxins are • Determining the level of dioxins in the air	• PowerPoint	II	
	15	SL	57.6 Formaldehyde — a common indoor air pollutant	• Indoor sources of formaldehyde • Determining the level of formaldehyde in indoor air	• PowerPoint	I,II	
	16	SL	57.7 Forensic chemistry	• Examples of use of instrumental analytical methods in forensic	• PowerPoint	I,III	

School Term	Weeks	SL/AL	Topics/ Extended Parts*	Learning Objectives/ Teaching Focus	Teaching and Learning Activities	Values#	Consolidation and Assessment
				chemistry			
	16	SL	57.8 Drink driving	• Blood alcohol content • Breath alcohol testing	• PowerPoint • Activity 57.1 — Designing and making a portable alcohol breathalyzer	II,IV	
	16	SL	57.9 Fingerprint analysis	• Three types of fingerprints existing at crime scenes • Developing fingerprints — fuming with iodine	• PowerPoint	II,IV	
	16	SL	57.10 The role of analytical chemistry in clinical diagnoses	♦ Example of use of analytical chemistry in clinical diagnoses	• PowerPoint	IV,V	• Unit exercise
	17-18		Christmas & New Year Holiday				
Second Term (3/1/2017-17/7/2017)	19		Revision week				
	20-21		Mock Examination				
	22-23		Lunar New Year Holiday				
	24-26		Revision week				

* The extended parts should be marked with asterisks. These parts should be more challenging and can be covered when the students can master the knowledge and skills covered in the conventional topics.

Core Values of Wah Yan College, Kowloon

I. Love and care
II. Strive for excellence
III. Respect and Justice
IV. Responsibility
V. Faith

Sustaining values

I. Love and care
   - ♦ Accept & feel positive about himself
   - ♦ Appreciation & Gratitude
   - ♦ Empathy & Compassion
   - ♦ Forgiveness & Reconciliation
   - ♦ Service
   - ♦ Family as a basic unit of society; marriage is the foundation of a family

II. Strive for excellence
   - ♦ Reflective
   - ♦ Commitment
   - ♦ Perseverance
   - ♦ Curiosity & willingness to learn
   - ♦ Value imagination and creativity

III. Respect and Justice
   - ♦ Life is valuable and respectable
   - ♦ Openness to good in all things
   - ♦ Respect for himself & others
   - ♦ Integrity
   - ♦ Faithfulness

IV. Responsibility

- Freedom & Self-discipline
- Care for the environment
- Social Identities: citizen identity, national identity and global citizen identity

V. Faith

- Experience of God
- Explore & practise one's faith
- Appreciate religious liturgies