SRI LANKAN SCHOOL MUSCAT			SCHEME OF WORK-CHEMISTRY		ACADEMIC YEAR 2016/2017
CLASS- 13 SCI/MATH			SUBJECT - CHEMISTRY		TEACHER – JANAKE GUNATHILAKE
MONTH	**PERIODS**	**UNIT**	**TOPICS**	**INTENDED LEARNING OBJECTIVES**	**REMARKS**
SEPTEMBER		**4**	**RATES, EQUILIBRIA AND FURTHER ORGANIC CHEMISTRY**		
Week 1	10	4.1	**Rates**	Demonstrate an understanding of the terms rate of reaction, rate equation,order of reaction, rate constant, half-life, rate-determining step.	
		4.1.1	Techniques Used To Measure The Rate Of A Reaction		
		4.1.2	Understanding The Terms Related To Rate Of Reaction	Deduce from experimental data for reactions with zero, first and second order kinetics	
		4.1.3	Graphical Representation Of Kinetic Measurements & The Interpretations	Present and interpret the results of kinetic measurements in graphical form, including concentration-time and rate-concentration graphs	
		4.1.4	Activation Energy And Types Of Catalysts	Demonstrate an understanding of the terms activation energy, heterogeneous and homogenous catalyst.	
Week-2	10	4.1.5	Relating Mechanisms To The Rate Determining Step	Investigate the reaction of iodine with propanone in acid to obtain data for the order with respect to the reactants and the hydrogen ion and make predictions about molecules/ions involved in the rate-determining step and possible mechanism. Use kinetic data as evidence for SN1 or SN2 mechanisms in the nucleophilic substitution reactions of halogenoalkanes.	
		4.1.6	The Mechanism Of The Reaction Of Iodine With Propanone		
			Assessment		
		4.2	**Entropy**	Demonstrate an understanding that the standard entropy of a substance depends mainly on its physical state but also on its complexity, since endothermic reactions can occur spontaneously at room temperature, enthalpy changes alone do not control whether reactions occur.	
		4.2.1	Introduction To Entropy		

Week 3	10	4.2.2	Changes In Entropy During Chemical Reactions	Demonstrate an understanding that the entropy of a substance increases with temperature.	
		4.2.3	Calculating Entropy Changes	Calculate the entropy change in the system for a reaction, ΔS_{system} , given entropy data. Use the expression $\Delta S_{surroundings} = -\Delta H/T$ to calculate the entropy change in the surroundings and hence ΔS_{total}. $\Delta S_{total} = \Delta S_{system} + \Delta s_{surroundings}$	
		4.2.4	Feasibility Of A Reaction, Thermodynamic Stability & Kinetic Stability	Demonstrate an understanding that the feasibility of a reaction depends on the balance between ΔS_{system} and $\Delta S_{surroundings}$, distinguish between the concepts of thermodynamic stability and kinetic inertness.	
Week-4	10	4.2.5	Prediciting Solubility From The Enthalpy & The Entropy Of A Solution	Define the term enthalpy of hydration of an ion and use it and lattice energy to calculate the enthalpy of solution of an ionic compound. Use entropy and enthalpy of solution values to predict the solubility of ionic compounds.	
			Assessment		
		4.3	**Equilibria**	Demonstrate an understanding of the term dynamic equilibrium as applied to states of matter, solutions and chemical reactions.	
		4.3.1	Introduction To Equilibria And Equilibrium Constant		
		4.3.2	Calculations Involving Kp & Kc	Calculate a value for the equilibrium constant for a reaction based on data from experiment. Construct expressions for Kc and Kp for homogeneous and heterogeneous systems, in terms of equilibrium concentrations or equilibrium partial pressures, perform simple calculations on Kc and Kp and work out the units of the equilibrium constants.	
OCTOBER Week 5	10	4.3.3	More Calculations Involving Kp & Kc	Demonstrate an understanding that when ΔStotal increases the magnitude of the equilibrium constant increases since $\Delta S_{total} = R\ln K$ Relate the effect of a change in temperature on the value of ΔS_{total}.	
		4.3.4	Determination Of An Equilibrium Constant		
		4.3.5	Relating Entropy To Equlibrium Constants		
			Assessment		

Week 6	10	4.4	**Application Of Rates And Equilibrium**	Demonstrate an understanding of how, if at all, and why a change in temperature, pressure or the presence of a catalyst affects the equilibrium constant and the equilibrium composition and recall the effects of changes of temperature and pressure on rate. Use information on enthalpy change and entropy to justify the conditions used to obtain economic yields in industrial processes, and understand that in reality industrial processes cannot be in equilibrium since the products are removed.	
		4.4.1	How Temperature, Pressure & Catalysts Affect The Equilibrium Constant		
		4.4.2	Choosing Conditions For Industrial Processes		
		4.4.3	Controlling Reactions For Safety, Yield, Cost & Atom Economy		
			Assessment		
Week 7	10	4.5	**Acid/Base Equilibria**	Demonstrate an understanding that a Brønsted–Lowry acid is a proton donor and use it to identify conjugate acid-base pairs and a base a proton acceptor and that acid-base equilibria involve transfer of protons.Use it to identify conjugate acid-base pairs.	
		4.5.1	Introduction To Acids And Bases		
		4.5.2	Introduction To pH And Measuring Of pH	Define the terms pH, Ka and Kw , pKa and pKw , and be able to carry out calculations relating the pH of strong acids and bases to their concentrations in mol dm^{-3}	
		4.5.3	Introduction To Ka And Kw For Strong/Weak Acids/Bases	Demonstrate an understanding that weak acids & bases are only slightly dissociated in aqueous solution, and apply the equilibrium law to deduce the expressions for equilibrium constants Ka & Kw	
Week 8	10	4.5.4	Determination Of Ka For A Weak Acid	Analyse and evaluate the results obtained from experiments to determine Ka for a weak acid by measuring the pH of a solution containing a known mass of acid, and discuss the assumptions made in this calculation	
		4.5.5	pH Changes During Acid-Base Titrations	Calculate the pH of a solution of a weak acid based on data for concentration and Ka , and discuss the assumptions made in this calculation.	
		4.5.6	Choosing Suitable Indicators	Use data about indicators, together with titration curves, to select a suitable indicator and the use of titrations in analysis.	

NOVEMBER		4.5.7	Finding Ka For A Weak Acid From A pH Titration	Use titration curves to show the buffer action and to determine Ka from the pH at the point where half the acid is neutralised.	
		4.5.8	An Introduction To Buffer Solutions	Explain the action of buffer solutions and carry out calculations on the pH of buffer solutions.	
		4.5.9	Buffers In Biological Systems	Explain the importance of buffer solutions in biological environments.	
			Assessment		
		4.6	**Further Organic Chemistry**	Recall the meaning of structural and E-Z isomerism	
		4.6.1	Isomerism And Chirality		
Week 10	10	4.6.2	Optical Activity Of Chiral Molecules	Demonstrate an understanding of the existence of optical isomerism resulting from chiral centre(s) in a molecule with asymmetric carbon atom(s) and understand optical isomers as object and non-superimposable mirror images.	
		4.6.3	Optical Activity And The Relationship Between Reaction Mechanism	Use data on optical activity of reactants and products as evidence for proposed mechanisms, as in S_N1 and S_N2 and addition to carbonyl compounds.	
		4.6.4	Introduction To Aldehydes And Ketones	Identify molecules that contain the aldehyde or ketone functional group.	
Week 11	10	4.6.5	Testing And Identifying Carbonyl Compounds	Explain the physical properties of aldehydes and ketones relating this to the lack of hydrogen bonding between molecules and their solubility in water in terms of hydrogen bonding with the water. Describe and carry out, where appropriate, the reactions of carbonyl compounds.	
		4.6.6	Introduction To Carboxylic Acids	Identify molecules that contain the carboxylic acid functional group.	
		4.6.7	Physical Properties, Preparation & Reactions Of Carboxylic Acids	Explain the physical properties of carboxylic acids in relation to their boiling temperatures and solubility due to hydrogen bonding. Describe the preparation of carboxylic acids to include oxidation of alcohols and carbonyl compounds and the hydrolysis of nitriles.	

Week 12	10	4.6.8	Synthesis & Reactions Of Esters	Demonstrate an understanding that these include acyl chlorides and esters and recognise their respective functional groups, giving examples of molecules containing these functional groups. Describe and carry out, where appropriate, the reactions of acyl chlorides and esters. Demonstrate an understanding of the importance of the formation of polyesters and describe their formation by condensation polymerisation of ethane-1,2-diol and benzene 1,4-dicarboxylic acid.	
		4.6.9	Polyesters		
		4.6.10	Reactions Of Acyl Chlorides		
			Assessment		
Week 13	10	4.7	**Spectroscopy And Chromatography**	Explain the effect of different types of radiation on molecules and how the principles of this are used in chemical analysis and in reactions.	
		4.7.1	Radiation And Its Effects On Molecules		
		4.7.2	High-Resolution Nuclear Magnetic Resonance Spectroscopy	Explain the use of high resolution nmr spectra to identify the structure of a molecule. Demonstrate an understanding of the use of IR spectra to follow the progress of a reaction involving change of functional groups.	
		4.7.3	Mass Spectroscopy	Interpret simple mass spectra to suggest possible structures of a simple compound from the m/e of the molecular ion and fragmentation patterns.	
		4.7.4	Gas Chromatography And High Performance Liquid Chromatography	Describe the principles of gas chromatography and HPLC as used as methods of separation of mixtures, prior to further analysis and also to determine if substances are present in industrial chemical processes.	
			Assessment		
Week 14	10	Revision & past papers			
DECEMBER	10				
Week 15		Revision & past papers			
Week 16	10	Withdrawal Examination			
Week 17		Paper Correction			

Week 18		Christmas vacation			
JANUARY	10	Discussion of term test paper		Demonstrate an understanding of the terms oxidation number, redox, half-reactions and use these to interpret reactions involving electron transfer. Relate changes in oxidation number to reaction stoichiometry.	
		5	**TRANSITION METALS AND ORGANIC NITROGEN CHEMISTRY**		
		5.1	**Redox Chemistry**		
Week 19		5.1.1	Oxidation Numbers And Stoichometry		
		5.1.2	Redox Titrations With Potassium Manganate(VII)	Demonstrate an understanding of the procedures of the redox titrations and carry out a redox titration.	
		5.1.3	Redox Titrations With Sodium Thiosulfate		
Week 20	10	5.1.4	Standard Electrode Potentials	Recall the definition of standard electrode potential and standard hydrogen electrode and understand the need for a reference electrode. Demonstrate an understanding that E_{cell} is directly proportional to the total entropy change and to lnK for a reaction.	
		5.1.5	Thermodynamic Feasibility And The Extent Of The Reactions	Set up some simple cells and calculate values of E_{cell} from standard electrode potential values and use them to predict the thermodynamic feasibility and extent of reactions.	
		5.1.6	Hydrogen And Alcohol Fuel Cells	Discuss the use of hydrogen and alcohol fuel cells as energy sources, including the source of the hydrogen and alcohol.	
		5.1.7	Breathalysers	Demonstrate an understanding of the principles of modern breathalysers based on an ethanol fuel cell and compare this to methods based on the use of IR & to the reduction of chromium compounds.	
			Assessment		
Week 21	10	5.2	**Transition Metals And Their Chemistry**	Describe transition metals & derive the electronic configuration of the atoms of the d-block (Sc - Zn) elements and their simple ions from their atomic number.	
		5.2.1	Introduction To Transition Metals		

Week 22	10	5.2.2	Characteristics Of Transition Metals	Discuss the evidence for the electronic configurations of the elements Sc to Zn based on successive ionisation energies. Recall that transition elements show variable oxidation number, form coloured ions in solution, form complex ions involving monodentate and bidentate ligands, can act as catalysts both as the elements and as their compounds.	
		5.2.3	Using Standard Electrode Potential To Predict Feasibility Of Forming Different Oxidation Numbers	Relate disproportionation reactions to standard electrode potentials and hence to E_{cell}.	
Week 23	10	5.2.4	Chemistry Of Copper	Use the chemistries of chromium and copper to illustrate and explain some properties of transition metals. Carry out experiments to investigate ligand exchange in copper complexes, study the redox chemistry of chromium in oxidation states Cr(VI), Cr(III) and Cr(II) and prepare a sample of a complex. Recall the shapes of complex ions limited to linear $[CuCl_2]^-$, planar $[Pt(NH_3)_2Cl_2]$, tetrahedral $[CrCl_4]^-$ and octahedral $[Cr(NH_3)_6]^{3+}$, $[Cu(H_2O)_6]^{2+}$ and other aqua complexes.	
		5.2.5	Chemistry Of Chromium		
		5.2.6	Preparing A Sample Of A Complex Ion		
FEBRUARY	10	5.2.7	Reactions Of Transition Metal Ions With Aqueous NaOH And NH_3	Carry out and interpret the reactions of transition metal ions with aqueous sodium hydroxide and aqueous ammonia, both in excess, limited to reactions with aqueous solutions of Cr(III), Mn(II), Fe(II), Fe(III), Ni(II), Cu(II), Zn(II).	
Week 24		5.2.8	Transition Metals As Catalysts	Recall that transition metals and their compounds are important as catalysts and that their activity may be associated with variable oxidation states of the elements or surface activity.	
		5.2.9	Modern Usage Of Transition Metals	Discuss the uses of transition metals and/or their compounds, e.g. in polychromic sun glasses, chemotherapy drugs.	
			Assessment		

Week 25	10	5.3	**Organic Chemistry - Arenes**	Use thermochemical, x-ray diffraction and infrared data as evidence for the structure and stability of the benzene ring.	
		5.3.1	Introduction To Benzene		
		5.3.2	Reactions Of Benzene	Describe the mechanism of the electrophilic substitution reactions of benzene in halogenation, nitration and Friedel-Crafts reactions including the formationof the electrophile.	
		5.3.3	Reactions Of Phenol	Carry out the reaction of phenol with bromine water and dilute nitric acid and use these results to illustrate the activation of the benzene ring.	
			Assessment		
Week 26	10	5.4	**Organic Nitrogen Compounds : Amines, Amides, Amino Acids And Proteins**	Describe and carry out, where appropriate reactions to investigate the typical behaviour of primary amines.	
		5.4.1	Amines And Aromatic Amines	Describe the reduction of aromatic nitro-compounds using tin and concentrated hydrochloric acid to form amines.	
		5.4.2	Preparation Of Paracetamol		
		5.4.3	Preparation Of Azo-Dyes	Describe and carry out, where appropriate, the reaction of aromatic amines with nitrous acid to form benzenediazonium ions followed by a coupling reaction with phenol to form a dye.	
Week 27	10	5.4.4	Polymers	Describe condensation polymerisation for the formation of polyesters & addition polymerisation. Draw the structural formulae of the repeat units of the polymers. Comment on the physical properties of polyamides and the solubility in water of the addition polymer poly(ethenol) in terms of hydrogen bonding.	
		5.4.5	Amino Acids	Describe and carry out, where appropriate, experiments to investigate the characteristic behaviour of amino acids.	
		5.4.6	Proteins		
			Assessment		
MARCH Week 28	10	5.5	**Organic Synthesis**	Give examples to illustrate the importance of organic synthesis in research for the production of useful products. Explain why sensitive methods of chemical analysis are important when planning and monitoring organic syntheses.	
		5.5.1	The Importance Of Synthetic Organic Chemistry		

Week 29	10	5.5.2	Identifying Organic Molecules For Synthesis	Deduce the empirical formulae, molecular formulae and structural formulae from data drawn from combustion analysis, elemental percentage composition, characteristic reactions of functional groups, infrared spectra, mass spectra and nuclear magnetic resonance.	
		5.5.3	Predicting Properties Of Organic Compounds	Predicting the properties of unfamiliar compounds containing one or more of the functional groups included in the specification, and explain these predictions.	
Week 30	10	5.5.4	Planning Synthetic Routes	Planning reaction schemes of up to four steps, recalling familiar reactions and using unfamiliar reactions given sufficient information.	
		5.5.5	Synthesis Of Stereo-Specific Drugs	Understanding why, in the synthesis of stereo-specific drugs, it is important to understand the mechanism of the reaction and how this can help to plan the synthesis.	
		5.5.6	Control Measures For Hazards In Organic Synthesis	Identifying appropriate control measures to reduce risk during a synthesis based upon data of hazards.	
		5.5.7	Combinatorial Chemistry	Explain why the pharmaceutical industry has adopted combinatorial chemistry in drug research, including passing reactants over reagents on polymer supports.	
			Assessment		
Week 31	10	Mock Examination			
Week 32		Distribution of answer scripts and PTI			
APRIL					
Week 33		New Year vacation			
Week 34					
Week 35					