CURRICULUM SUMMARY – September to December 2018

SUBJECT: IBDP Chemistry YEAR GROUP: IB2 TEACHER: Dr Kumi Osanai

Week	Dates	Learning objectives	Activities (in brief)	Preparation	TOK-relevant questions
1	4 – 7 September	**Introduction/ Laboratory safety** To able to understand the basic safety regulations when working in a laboratory. To be able to acquire how to handle any hazardous situation occurred in a laboratory. **9.Redox processes** Deduction of the oxidation states of an atom in an ion or a compound. Deduction of the name of a transition metal compound from a given formula, applying oxidation numbers represented by Roman numerals. **(HL Additional)** Calculation of cell potentials using standard electrode potentials. Prediction of whether a reaction is spontaneous or not using E^o values. Determination of standard free-energy changes (ΔG^o) using standard electrode potentials.	Introduction of IA Understand the course descriptor Formulating half equations in various redox reactions.	Identifying the oxidation state in simple compounds in IGCSE. Constructing half equations in various redox reactions.	*Oxidation states are useful when explaining redox reactions. Are artificial conversions a useful or valid way of clarifying knowledge?*
2	10 – 14 September	Identification of the species oxidized and reduced and the oxidizing and reducing agents, in redox reactions. Deduction of redox reactions using half-equations in acidic or neutral solutions. Deduction of the feasibility of a redox reaction from the activity series or reaction data.	Various oxidation states of Vanadium. Various oxidation states of Manganese. Constructing an electrolytic cell and		

		(HL Additional) Explanation of the products formed during the electrolysis of aqueous solutions. Perform lab experiments that could include single replacement reactions in aqueous solutions. Determination of the relative amounts of products formed during electrolytic processes.	observation of products on each electrode. Observing changes during the process of electroplating.		
3	17 – 21 September	Solution of a range of redox titration problems. Application of the Winkler Method to calculate BOD. Construction and annotation of both types of electrochemical cells. Explanation of how a redox reaction is used to produce electricity in a voltaic cell and how current is conducted in an electrolytic cell. Distinction between electron and ion flow in both electrochemical cells. Performance of laboratory experiments involving a typical voltaic cell using two metal/metal-ion half-cells. Deduction of the products of the electrolysis of a molten salt. **(HL Additional)** Explanation of the process of electroplating.	Redox titration Constructing a voltaic cell. Observation of products formed on each electrode of a simple chemical cell. Observing changes during the process of electroplating.		
4	24 – 28 September	Chapter test Feedback on the chapter test **10.Organic chemistry** Explanation of the trends in boiling points of members of a homologous series. Distinction between empirical, molecular and structural formulas. Identification of different classes: alkanes, alkenes, alkynes, halogenoalkanes, alcohols,	Nomenclature of organic compounds. Rate of Sn1 and Sn2 reactions. Drawing curly arrows to express movement of electrons in mechanism.	Revision of the fundamental knowledge of organic chemistry in IGCSE.	

		ethers, aldehydes, ketones, esters, carboxylic acids, amines, amides, nitriles and arenes. Identification of typical functional groups in molecules eg phenyl, hydroxyl, carbonyl, carboxyl, carboxamide, aldehyde, ester, ether, amine, nitrile, alkyl, alkenyl and alkynyl. **(HL Additional)** *Nucleophilic Substitution Reactions:* Explanation of why hydroxide is a better nucleophile than water. Deduction of the mechanism of the nucleophilic substitution reactions of halogenoalkanes with aqueous sodium hydroxide in terms of SN1 and SN2 mechanisms. Explanation of how the rate depends on the identity of the halogen (ie the leaving group), whether the halogenoalkane is primary, secondary or tertiary and the choice of solvent. Outline of the difference between protic and aprotic solvents.			
5	1 – 5 October	**10.Organic chemistry** Construction of 3-D models (real or virtual) of organic molecules. Application of IUPAC rules in the nomenclature of straight-chain and branched-chain isomers. Identification of primary, secondary and tertiary carbon atoms in halogenoalkanes and alcohols and primary, secondary and tertiary nitrogen atoms in amines. Discussion of the structure of benzene using physical and chemical evidence. **(HL Additional)** *Electrophilic Addition Reactions:*	Nomenclature of branched organic compounds. Drawing curly arrows to express movement of electrons in mechanism.		*Kekule claimed that the inspiration for the cyclic structure of benzene came from a dream. What role do the less analytical ways of knowledge play in the acquisition of scientific knowledge?*

		Deduction of the mechanism of the electrophilic addition reactions of alkenes with halogens/interhalogens and hydrogen halides.			
6	8 – 12 October	**10.Organic chemistry** *Alkanes:* Writing equations for the complete and incomplete combustion of hydrocarbons. Explanation of the reaction of methane and ethane with halogens in terms of a free-radical substitution mechanism involving photochemical homolytic fission. **(HL Additional)** *Electrophilic Substitution Reactions:* Deduction of the mechanism of the nitration (electrophilic substitution) reaction of benzene (using a mixture of concentrated nitric acid and sulfuric acid).	Drawing curly arrows to express movement of electrons in mechanism.		
7	15 – 19 October	**10.Organic chemistry** *Alkenes:* Writing equations for the reactions of alkenes with hydrogen and halogens and of symmetrical alkenes with hydrogen halides and water. Outline of the addition polymerization of alkenes. Relationship between the structure of the monomer to the polymer and repeating unit. **(HL Additional)** *Reduction Reactions:* Writing reduction reactions of carbonyl containing compounds: aldehydes and ketones to primary and secondary alcohols and	1. Reactions of aldehydes and ketones	Revision of linkage of addition polymers vs condensation polymers.	*A retro-synthetic approach is often used in the design of synthetic routes.* *What are the roles of imagination, intuition and reasoning in finding solutions to practical problems?*

		carboxylic acids to alcohols, using suitable reducing agents. Conversion of nitrobenzene to phenylamine via a two-stage reaction. Deduction of multi-step synthetic routes given starting reagents and the product(s).			
8	22 – 26 October	*Alcohols:* Writing equations for the complete combustion of alcohols. Writing equations for the oxidation reactions of primary and secondary alcohols (using acidified potassium dichromate(VI) or potassium manganate(VII) as oxidizing agents). Explanation of distillation and reflux in the isolation of the aldehyde and carboxylic acid products. Writing the equation for the condensation reaction of an alcohol with a carboxylic acid, in the presence of a catalyst (eg concentrated sulfuric acid) to form an ester. *Halogenoalkanes:* Writing the equation for the substitution reactions of halogenoalkanes with aqueous sodium hydroxide. **(HL Additional)** Construction of 3-D models (real or virtual) of a wide range of stereoisomers. Explanation of stereoisomerism in non-cyclic alkenes and C3 and C4 cycloalkanes. Comparison between the physical and chemical properties of enantiomers. Description and explanation of optical isomers in simple organic molecules.	Chemical properties of ethanol. Oxidation reaction of alcohol. Synthesising 6, 6-Nylon.		*One of the challenges for the scientist and the artist is to represent the three-dimensional world in two dimensions. What are the similarities and differences in the two approaches? What is the role of the different ways of knowing in the two approaches?*

		Distinction between optical isomers using a polarimeter.			
	29 October– 2 November	Mid-Term Break	Mid-Term Break		
9	5 – 9 November	Chapter test Feedback on the chapter test			
10	12 – 16 November	**Internal Assessment**	Designing a lab. Order chemical if required.		
11	19 – 23 November	**Internal Assessment**	Implementation of IA.		
12	26 – 30 November	**Internal Assessment**	Writing up a report.		
13	3 – 7 December	**Option D: Medicinal Chemistry** **D.1 Pharmaceutical products and drug action** Discussion of experimental foundations for therapeutic index and therapeutic window through both animal and human studies. Discussion of drug administration methods. Comparison of how functional groups, polarity and medicinal administration can affect bioavailability.		Revision of functional groups of various organic compounds (Chapter 10). Revision of polarity of functional groups (Chapter 4).	*Drugs trials use double blind tests. When is it ethically acceptable to deceive people?* *All drugs carry risks as well as benefits. Who should ultimately be responsible for assessing these? Public bodies can protect the individual but also limit their freedom. How do we know what is best for society and the individual?*
14	10 – 14 December	**D.2 Aspirin and penicillin** *Aspirin*	Aspirin titration.	Revision of theoretical yield	*"Chance favours only the prepared mind."*

		Description of the use of salicylic acid and its derivatives as mild analgesics. Explanation of the synthesis of aspirin from salicylic acid, including yield, purity by recrystallization and characterization using IR and melting point. Discussion of the synergistic effects of aspirin with alcohol. Discussion of how the aspirin can be chemically modified into a salt to increase its aqueous solubility and how this facilitates its bioavailability. *Penicillin* Discussion of the effects of chemically modifying the side-chain of penicillins. Discussion of the importance of patient compliance and the effects of the over-prescription of penicillin. Explanation of the importance of the beta-lactam ring on the action of penicillin.	Molecular model of 4-menbered ring. Discussion of over-prescribed antibiotics and their risk of cross resistance.	calculations (Chapter 1). Revision of IR spectrum (Chapter 11).	*(Louis Pasteur). Fleming's discovery of penicillin is often described as serendipitous but the significance of his observations would have been missed by non-experts. What influence does an open-minded attitude have on our perceptions?*
15	17 – 21 December	**D.3 Opiates** Explanation of the synthesis of codeine and diamorphine from morphine. Description and explanation of the use of strong analgesics. Comparison of the structures of morphine, codeine and diamorphine (heroin). Discussion of the advantages and disadvantages of using morphine and its derivatives as strong analgesics. Discussion of side effects and addiction to opiate compounds. Explanation of the increased potency of diamorphine compared to morphine based on their chemical structure and solubility.	Watching a video, socioeconomic problems of use of analgesics.	Revision of functional groups (Chapter 10). Revision of polarity (Chapter 4).	*Cultures often clash over different perspectives and ideas. Is there any knowledge which is independent of culture?*