IB CHEMISTRY YEAR 1 - Unit 3

IB Chemistry PLC		Subject Group and Course	Group 4 - Chemistry		
Course Part and Topic	**UNIT 3 - ELECTROCHEMICAL CELLS** Reactivity 2.1 - How much? The amount of chemical change Reactivity 3.2 - Electron transfer reactions	**SL or HL / Year 1 or 2**	SL Year 1	**Dates**	Semester 2 - Weeks 1 to 9
Unit Description and Texts		**DP Assessment(s) for Unit**			
Resources for 2025 "New" Syllabus ● Textbook TBD – pending evaluation of resources ● IB Chemistry Guide First Assessment 2025 ● InThinking IB subject site for Chemistry ● IB Chemistry Schoology Course Resources for 2016 "Old" Syllabus ● Murphy et al. *Oxford IB Diploma Programme: Chemistry Course Companion*, 2014 edition. ● Brown and Ford. *Pearson Baccalaureate Standard Level Chemistry*, 2nd edition. ● Hodder Study and Revision Guide for the IB Diploma ● Hodder IA Internal Assessment for Chemistry		● Unit 03 Summative Assessment - *Paper 1 and 2 questions modeled after the real IB Exam Papers (2025 syllabus)*			

INQUIRY: establishing the purpose of the unit

Transfer Goals *List here one to three big, overarching, long-term goals for this unit. Transfer goals are the major goals that ask students to "transfer" or apply their knowledge, skills, and concepts at the end of the unit under new/different circumstances, and on their own without scaffolding from the teacher.*
Phenomenon: Wearable energy harvesting devices utilize electrochemical cells to capture and store energy from body movements or the environment. Statement of Inquiry: Redox reactions and electrochemical cells allow us to understand the dynamic exchange of electrons leading to the

generation of electrical energy or powering chemical transformations in various systems.

1. **Students can** use chemical equations to calculate reacting ratios.
2. **Students can** explain what happens when electrons are transferred.

ACTION: teaching and learning through inquiry

Content / Skills / Concepts - Essential Understandings	**Learning Process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
Reactivity 2.1.1 **Chemical equations show the ratio of reactants and products in a reaction.** *Deduce chemical equations when reactants and products are specified.* ● Include the use of state symbols in chemical equations. **Reactivity 2.1.2** **The mole ratio of an equation can be used to determine the masses and/or volumes of reactants and products; the concentrations of reactants and products for reactions occurring in solution.** *Calculate reacting masses and/or volumes and concentrations of reactants and products.* ● Avogadro's law and definitions of molar concentration are covered in Structure 1.4. ● The values for Ar given in the data booklet to two decimal places should be used in calculations. **Reactivity 2.1.3** **The limiting reactant determines the theoretical yield.** *Identify the limiting and excess reactants from given data.* ● Distinguish between the theoretical yield and the experimental yield. **Reactivity 2.1.4** **Solve problems involving reacting quantities, limiting and excess reactants, theoretical, experimental and percentage yields.** **Reactivity 2.1.5** **The atom economy is a measure of efficiency in green chemistry.** *Calculate the atom economy from the stoichiometry of a reaction.* ● Include discussion of the inverse relationship between atom economy and wastage in industrial processes. ● The equation for calculation of the atom economy is given in the data booklet. **Reactivity 3.2.1** **Oxidation and reduction can be described in terms of electron transfer, change in oxidation state, oxygen gain/loss or hydrogen loss/gain.** *Deduce oxidation states of an atom in a compound or an ion.*	Learning experiences and strategies/planning for self-supporting learning: ☒ Lecture □ Socratic seminar ☒ Small group/pair work ☒ PowerPoint lecture/notes ☒ Individual presentations ☒ Group presentations ☒ Student lecture/leading □ Interdisciplinary learning Details: *Students will learn through a combination of presentations, small group work, practice problems, and lab work.*

Identify the oxidized and reduced species and the oxidizing and reducing agents in a chemical reaction.

- Include examples to illustrate the variable oxidation states of transition element ions and of most main group non-metals.
- Include the use of oxidation numbers in the naming of compounds.

Reactivity 3.2.2

Half-equations separate the processes of oxidation and reduction, showing the loss or gain of electrons.

Deduce redox half-equations and equations in acidic or neutral solutions.

Reactivity 3.2.3

The relative ease of oxidation and reduction of an element in a group can be predicted from its position in the periodic table.

The reactions between metals and aqueous metal ions demonstrate the relative ease of oxidation of different metals.

Predict the relative ease of oxidation of metals.

Predict the relative ease of reduction of halogens.

Interpret data regarding metal and metal ion reactions.

- The relative reactivity of metals observed in metal/metal ion displacement reactions does not need to be learned; appropriate data will be supplied in examination questions.

Reactivity 3.2.4

Acids react with reactive metals to release hydrogen.

Deduce equations for reactions of reactive metals with dilute HCl and H_2SO_4.

Reactivity 3.2.5

Oxidation occurs at the anode and reduction occurs at the cathode in electrochemical cells.

Identify electrodes as anode and cathode, and identify their signs/polarities in voltaic cells and electrolytic cells, based on the type of reaction occurring at the electrode.

Reactivity 3.2.6

A primary (voltaic) cell is an electrochemical cell that converts energy from spontaneous redox reactions to electrical energy.

Explain the direction of electron flow from anode to cathode in the external circuit, and ion movement across the salt bridge.

- Construction of primary cells should include: half-cells containing metal/metal ion, anode, cathode, electric circuit, salt bridge.

Reactivity 3.2.7

Secondary (rechargeable) cells involve redox reactions that can be reversed using electrical energy.

Deduce the reactions of the charging process from given electrode reactions for discharge, and vice versa.

- Include discussion of advantages and disadvantages of fuel cells, primary cells and secondary cells.

Reactivity 3.2.8

An electrolytic cell is an electrochemical cell that converts electrical energy to chemical energy by bringing about non-spontaneous reactions.

Explain how current is conducted in an electrolytic cell.

Deduce the products of the electrolysis of a molten salt.

- Construction of electrolytic cells should include: DC power source connected to anode and cathode, electrolyte.

Reactivity 3.2.9

Functional groups in organic compounds may undergo oxidation.

☒ Other(s): *practice problems, lab work*

Formative assessment(s):

Short closer quizzes for each lesson
Practice with Tools and Inquiries
Daily formative checks

Summative assessments:

Unit Exam - *Paper 1 and 2 questions modeled after the real IB Exam Papers (2025 syllabus)*

Laboratory Assignment - *assessing Tools and Inquiries practiced in the Unit*

Differentiation:

☒ Affirm identity - build self-esteem

☒ Value prior knowledge

☒ Scaffold learning

☒ Extend learning

Details:

- *SWD/504 – Accommodations Provided*
- *ELL – Reading & Vocabulary Support*
- *Intervention Support*
- *Extensions – Enrichment Tasks and Project*

Tools and Inquiries:

Reactivity 2.1.3

Deduce equations to show changes in the functional groups during oxidation of primary and secondary alcohols, including the two-step reaction in the oxidation of primary alcohols. ● Include explanation of the experimental set-up for distillation and reflux. ● Include the fact that tertiary alcohols are not oxidized under similar conditions. ● Names and formulas of specific oxidizing agents, and the mechanisms of oxidation, will not be assessed. **Reactivity 3.2.10** **Functional groups in organic compounds may undergo reduction.** *Deduce equations to show reduction of carboxylic acids to primary alcohols via the aldehyde, and reduction of ketones to secondary alcohols.* ● Include the role of hydride ions in the reduction reaction. ● Names and formulas of specific reducing agents, and the mechanisms of reduction, will not be assessed. **Reactivity 3.2.11** **Reduction of unsaturated compounds by the addition of hydrogen lowers the degree of unsaturation.** *Deduce the products of the reactions of hydrogen with alkenes and alkynes.*	● Tool 1, Inquiry 1, 2, 3—What errors may cause the experimental yield to be i) higher and ii) lower than the theoretical yield? **Reactivity 3.2.2** ● Tool 1, Inquiry 2—Why are some redox titrations described as "self-indicating"? **Reactivity 3.2.3** ● Tool 1, Inquiry 2—What observations can be made when metals are mixed with aqueous metal ions, and solutions of halogens are mixed with aqueous halide ions?

Approaches to Learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

☒ Thinking

☒ Social

☒ Communication

☒ Self-management

☒ Research

Details:

Students will be continuously challenged to develop higher-order thinking skills as they take prior knowledge, combine it with new content, and synthesize new understandings and connections.

Students will build social groups through group work and intentional reflection activities.

Students will communicate their findings to their peers in the form of small-group presentations.

Students will continue to work on self-management and organization skills.

Students will complete background research to develop and extend their learning.

Language and Learning *Check the boxes for any explicit language and learning connections made during the unit. For more information on the IB's approach to language and learning, please see the guide.*	**TOK Connections** *Check the boxes for any explicit TOK connections made during the unit*	**CAS Connections** *Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section explaining how students engaged in CAS for this unit.*
☒ Activating background knowledge ☒ Scaffolding for new learning ☒ Acquisition of new learning through practice ☒ Demonstrating proficiency Details: *Content and vocabulary introduced in previous science courses will be used in this unit.* *Students will use many of the concepts from this unit in future units throughout the two-year course.* *Students will acquire new vocabulary.* *Students will continually demonstrate proficiency with chemistry vocabulary in class discussions and group work.*	□ Personal and shared knowledge ☒ Ways of knowing □ Areas of knowledge □ The knowledge framework Details: *TOK knowledge questions will be included as discussion options for each lesson.*	☒ Creativity □ Activity □ Service Details: *Students will be encouraged to consider the creativity involved in scientific experimentation. Students can explore alternative ways (visual, for example) to express and explain this creativity to others.*
Resources		

List and attach (if applicable) any resources used in this unit
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REFLECTION: considering the planning, process, and impact of the inquiry

What worked well	**What didn’t work well**	**Notes / Changes / Suggestions**
List the portions of the unit (content, assessment, planning) that were successful	*List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	*List any notes, suggestions, or considerations for the future teaching of this unit*