



SUBJECT and GRADE	Physical Sciences Gr 12
TERM 3	Week 2
TOPIC	Electrochemical Reactions (This section must be read in conjunction with the CAPS, p. 134 - 137.)
AIMS OF LESSONS	<p>Electrolytic cells and Galvanic/Voltaic cells</p> <ul style="list-style-type: none">• Define the galvanic cell as a cell in which chemical energy is converted into electrical energy. A galvanic (voltaic) cell has self-sustaining electrode reactions.• Define the electrolytic cell as a cell in which electrical energy is converted into chemical energy.• Define oxidation and reduction in terms of electron (e⁻) transfer: Oxidation is a loss of electrons. Reduction is a gain of electrons.• Define oxidation and reduction in terms of oxidation numbers: Oxidation: An increase in oxidation number Reduction: A decrease in oxidation number• Define an oxidising agent and a reducing agent in terms of oxidation and reduction: Oxidising agent: A substance that is reduced/gains electrons. Reducing agent: A substance that is oxidised/loses electrons.• Define an anode and a cathode in terms of oxidation and reduction: Anode: The electrode where oxidation takes place Cathode: The electrode where reduction takes place• Define an electrolyte as a solution/liquid/dissolved substance that conducts electricity through the movement of ions• Electrolysis: The chemical process in which electrical energy is converted to chemical energy OR the use of electrical energy to produce a chemical change.

Relation of current and potential difference to rate and equilibrium

- Give and explain the relationship between current in an electrolytic cell and the rate of the reaction.
- State that the potential difference of a galvanic cell (V_{cell}) is related to the extent to which the spontaneous cell reaction has reached equilibrium.
- State and use the qualitative relationship between V_{cell} and the concentration of product ions and reactant ions for the spontaneous reaction, namely V_{cell} decreases as the concentration of product ions increases and the concentration of reactant ions decrease until equilibrium is reached at which the $V_{\text{cell}} = 0$ (the cell is 'flat'). (Qualitative treatment only. Nernst equation is NOT required.)

Understanding of the processes and redox reactions taking place in galvanic cells

- Describe the movement of ions in the solutions.
 - State the direction of electron flow in the external circuit.
 - Write down the half-reactions that occur at the electrodes.
 - State the function of the salt bridge.
 - Use cell notation or diagrams to represent a galvanic cell. When writing cell notation, the following convention should be used:
 - o The $\text{H}_2 | \text{H}^+$ half-cell is treated just like any other half-cell.
 - o Cell terminals (electrodes) are written on the outside of the cell notation.
 - o Active electrodes: reducing agent | oxidised species | | oxidising agent | reduced species
 - o Inert electrodes (usually Pt or C): Pt | reducing agent | oxidised species | | oxidising agent | reduced species | Pt
- Example: $\text{Pt}(s) | \text{Cl}^-(aq) | \text{Cl}_2(g) || \text{F}_2(g) | \text{F}^-(aq) | \text{Pt}(s)$
- Predict the half-cell in which oxidation will take place when two half-cells are connected.
 - Predict the half-cell in which reduction will take place when connected to another halfcell.
 - Write down the overall cell reaction by combining two half-reactions.
 - Use the Table of Standard Reduction Potentials to calculate the emf of a standard galvanic cell.

	<ul style="list-style-type: none"> • Use a positive value of the standard emf as an indication that the reaction is spontaneous under standard conditions. <p>Standard electrode potentials</p> <ul style="list-style-type: none"> • Write down the standard conditions under which standard electrode potentials are determined. • Describe the standard hydrogen electrode and explain its role as the reference electrode. • Explain how standard electrode potentials can be determined using the reference electrode and state the convention regarding positive and negative values. 	
RESOURCES	<p>Paper based resources</p> <p>Learners are referred to the:</p> <ul style="list-style-type: none"> • <i>Electrochemical Cells</i> topic in the textbook or study guides that learners will have on hand. • <i>Examination Guideline</i> (page 22 - 23) • <i>Mind the Gap</i> books (pages 155 - 192) • <i>Past NSC Examination papers</i> (refer to Paper 2) 	<p>Digital resources</p> <p>Refer to the relevant digital resources:</p> <ul style="list-style-type: none"> • www.wcedportal.co.za • HeyScience App for Physical Sciences • Past NSC Examination Question papers • You Tube videos <p>Introduction to galvanic Cells https://youtu.be/9bIB-uMTIAM</p> <p>Electrochemistry Practice Problems an Introduction https://youtu.be/S9frctwDyL0</p>
INTRODUCTION	<p>Parts 1, 2 and 3</p> <ol style="list-style-type: none"> 1. You should be able to explain what a Voltaic cell is – use the Cu/Zn voltaic cell. Read through <i>Mind the Gap</i> pages 169 - 173 2. You should be able to explain how a voltaic cell operates – the electrode at which Oxidation occurs and the electrode at which Reduction occurs 	

	<p>3. You should be able explain the movement of electrons from anode electrode to cathode electrode in external circuit and movement of ions through the salt bridge in the internal circuit.</p> <p>4. Observe the following youtube videos:</p> <p style="padding-left: 40px;">Introduction to galvanic Cells https://youtu.be/9bIB-uMTIAM</p> <p style="padding-left: 40px;">Electrochemistry Practice Problems an Introduction https://youtu.be/S9frctwDyL0</p> <p>5. Now attempt the following Activities from Mind the Gap: Page 172: Activity 7 Page 175: Activity 8 and 9 Page 176: Activity 10</p>	
<p>CONCEPTS AND SKILLS</p>	<p>Part 4</p> <ul style="list-style-type: none"> • You should be able to explain how a Standard Hydrogen electrode works. Read through Mind the Gap pages 178 • You should be able to calculate the emf of an electrochemical cell • Now go through the Worked examples on page 181 – 184 	<p>CAN YOU?</p> <ul style="list-style-type: none"> • Explain what a voltaic cell is? • Explain oxidation and reduction ito electron transfer • Define what an oxidizing agent and reducing agent is • Identify the electrode where oxidation and reduction occur in a voltaic cell. • Identify the anode and cathode in a voltaic cell

		<ul style="list-style-type: none"> • Identify the direction of movement of electrons in the external circuit and the movement of ions in the internal circuit. • Calculate the emf of a voltaic cell. • Write down the cell notation.
ACTIVITIES/ASSESSMENT	Part 5 <ul style="list-style-type: none"> • Now practice the Activities 10 - 17 	
CONSOLIDATION	Work through practice questions on pages 4, 5, 7, 13 and 14. Link: https://drive.google.com/file/d/14C1MDaCpiwExQYmE-RSpANLMR3PmL3sh/view?usp=sharing	
VALUES	Observation; Identify; analyzation; making conclusions.	