## **Year 12 Chemistry:** Unit 3 – Equilibrium, acids and REDOX reactions

In Unit 3, students explore the reversibility of reactions in a variety of chemical systems at different scales; acid-base equilibrium systems and their applications; the principles of oxidation and reduction reactions; and the production of electricity from electrochemical cells. Processes that are reversible will respond to a range of factors and can achieve a state of dynamic equilibrium, while contemporary models can be used to explain the nature of acids and bases, and their properties and uses.

Students conduct investigations on electrochemical cells and volumetric analysis applications. They examine qualitative and quantitative data about acids, equilibrium and redox to analyse trends and draw conclusions.

They participate in experiments and investigations related to the principles of dynamic chemical equilibrium and how these can be applied to chemical processes and systems; electrochemical cells, the choice of materials used and the voltage produced by these cells; pH scale and the extent of dissociation of acids and bases; and the concentrations of ions in an aqueous solution. Collaborative experimental work allows students to progressively develop their science inquiry skills, while gaining an enhanced appreciation of the importance of equilibrium and redox in the real world.

Contexts that could be investigated include environmental issues, such as acid rain and oceanic acidification; food or wine production; the historical development of theories about acids, corrosion and corrosion prevention; fuel cells; and uses of electrochemistry. Through the investigation of appropriate contexts, students explore the ways in which models and theories related to acid-base and redox reactions, and their applications, have developed over time, and the ways in which chemistry contributes to contemporary debate in industrial and environmental contexts, including the use of energy, evaluation of risk and action for sustainability.

## Unit objectives

Unit objectives are drawn from the syllabus objectives and are contextualised for the subject matter and requirements of the unit. Each unit objective must be assessed at least once.

Students will:
1. describe and explain chemical equilibrium systems and oxidation and reduction
2. apply understanding of chemical equilibrium systems and oxidation and reduction
3. analyse evidence about chemical equilibrium systems and oxidation and reduction
4. interpret evidence about chemical equilibrium systems and oxidation and reduction
5. investigate phenomena associated with chemical equilibrium systems and oxidation and reduction
6. evaluate processes, claims and conclusions about chemical equilibrium systems and oxidation and reduction
7. communicate understandings, findings, arguments and conclusions about chemical equilibrium systems and oxidation and reduction

## Unit Assessment

IA2 – Student Experiment
Timing: Handed out Term 1, week 10 and is due Term 2, week 7 (on Monday)

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|---|---|
| W5<br>Equilibrium<br>(Chemical)<br>Ch 2.1 P44 | Closed systems and physical changes |
| | Dynamic equilibrium<br>Activation energy |
| | Graphical data |
| W6<br>Factors that affect Equilibrium<br>Ch 2.2 p49 | Le Chatelier's principle<br>& collision theory |
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| Equilibrium Constants<br>Ch 2.4 p62 | Equilibrium Constants Kc |
| W7 | Equilibrium Constants |
| Equilibrium constants cont…..<br>Ch 2,4 p62 | Solving problems calculating equilibrium constants and concentration of reactants |
| Properties of acids and bases<br>Ch 3.1 p76 & Ch3.2 p78 | Properties of acids and bases |
| W8 | DO some titrations with<br>Properties of acids and bases (1 hr) |
| SUBMIT year 11 Results | Titrations<br>End point<br>Equivalence point<br>Indicators |
| | Titrations<br>Calculations<br>Practice data test like qns |
| **YEAR 12 TERM 1**<br>W1 | |
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| | Review Last year's concepts |
| | Review Last year's concepts |
| W2<br>Unit 3 Topic 1<br>Ch 3.3 p81<br>pH scale<br>ch 3.4 p83<br>Ch 3.5 p87<br>Bronsted Lowrey Model | Water as a weak electrolyte and finish catch up |
| | pH calcs & pOH calcs |
| | Bronstead-Lowry |
| W3 | Buffers, do some review Qn's |

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| Ch 3.7 p92 (Buffers)<br>Dissociation Constant<br>Ch 4.1 p98<br>Ch 4.2 p103 (calcs) | Ka & Kb 4.1 p99<br>pKa and PKb including calcs |
| W4<br>Ch 4.3 p106 (indicators)<br>Titrations<br>Chap 5.1 & 5.2 p114 | Indicators includes graphs<br>Intro to titrations and how to..<br>Mandatory prac |
| W5<br><br>Chap 5.3 Page126-131<br>Volumetric analysis<br>Review from last year | Prac cont… and calcs<br>Acid base titrations and curves<br>Block exams |
| W6 | Revision<br>Revision<br>IA1 Data Test |
| W7<br>Redox<br>Ch 6.1 p138<br>Ox numbers<br>Ch 6.2 p145 | Displacement<br>Electron loss/gain<br>Definitions<br>Displacement rn – Mandatory prac single displacement p406<br>Ox state, Ox numbers |
| W8<br>Half equations and overall redox eq<br>Ch 6.3 p150<br>Submit results for IA1<br>Galvanic cells<br>Chp 7,1 p162 | ½ equations and overall<br>½ equations cont…..<br>Electrochemical Cells:<br>Electrochem series<br>Galvanic cells including structure & equations |
| W9<br>Galvanic cells<br>Mandatory prac p407 | Galvanic cells cont….<br>Mandatory prac- galvanic cell<br>Mandatory prac-<br>Hand out IA2 |
| W10<br>Standard electrode potential<br>Ch 7.2 p174<br>Applications of spontaneous reactions<br>Ch 7.3 p179 | Standard electrode potential<br>Alkaline batteries and fuel cells<br>Intro to electrolytic cells<br>Electrolytic cells – # simulation |

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| Intro to electrolytic cells<br>Ch 8.1 p190 | |
| **Year 12 TERM 2**<br>W1<br>Electrolytic cells<br>Ch 8.1 & 8,2 | Electrolytic cells |
| | Electrolytic cells |
| | Prac on Electrolytic |
| W2 | Electrolytic |
| | IA2 (1) Discuss mods to Prac |
| | IA2 (2) Rationale and mods |
| W3 | IA2 (3) Do the prac |
| | IA2 (4) Analysis |
| | IA2(5) Analysis |
| W4 | IA2 (6) Evaluation |
| | IA2 (7) Evaluation |
| | IA2 (8) Evaluation |