Topic 9: Oxidation and reduction (7 hours)

Aim 8: The Industrial Revolution was the consequence of the mass production of iron by a reduction process. However, iron spontaneously reverts back to an oxidized form. What price do we continue to pay in terms of energy and waste for choosing a metal so prone to oxidation and why was it chosen?

9.1 Introduction to oxidation and reduction

2 hours

	Assessment statement	Obj	Teacher's notes
9.1.1	Define *oxidation* and *reduction* in terms of electron loss and gain.	1	
9.1.2	Deduce the oxidation number of an element in a compound.	3	Oxidation numbers should be shown by a sign (+ or –) and a number, for example, +7 for Mn in $KMnO_4$. **TOK:** Are oxidation numbers "real"?
9.1.3	State the names of compounds using oxidation numbers.	1	Oxidation numbers in names of compounds are represented by Roman numerals, for example, iron(II) oxide, iron(III) oxide. **TOK:** Chemistry has developed a systematic language that has resulted in older names becoming obsolete. What has been gained and lost in this process?
9.1.4	Deduce whether an element undergoes oxidation or reduction in reactions using oxidation numbers.	3	

9.2 Redox equations

1 hour

	Assessment statement	Obj	Teacher's notes
9.2.1	Deduce simple oxidation and reduction half-equations given the species involved in a redox reaction.	3	
9.2.2	Deduce redox equations using half-equations.	3	H^+ and H_2O should be used where necessary to balance half-equations in acid solution. The balancing of equations for reactions in alkaline solution will not be assessed.
9.2.3	Define the terms *oxidizing agent* and *reducing agent*.	1	
9.2.4	Identify the oxidizing and reducing	2	

	agents in redox equations.		

9.3 Reactivity

1 hour

	Assessment statement	Obj	Teacher's notes
9.3.1	Deduce a reactivity series based on the chemical behaviour of a group of oxidizing and reducing agents.	3	Examples include displacement reactions of metals and halogens. Standard electrode potentials will not be assessed.
9.3.2	Deduce the feasibility of a redox reaction from a given reactivity series.	3	Students are not expected to recall a specific reactivity series.

9.4 Voltaic cells

1 hour

	Assessment statement	Obj	Teacher's notes
9.4.1	Explain how a redox reaction is used to produce electricity in a voltaic cell.	3	This should include a diagram to show how two half-cells can be connected by a salt bridge. Examples of half-cells are Mg, Zn, Fe and Cu in solutions of their ions.
9.4.2	State that oxidation occurs at the negative electrode (anode) and reduction occurs at the positive electrode (cathode).	1	

9.5 Electrolytic cells

2 hours

	Assessment statement	Obj	Teacher's notes
9.5.1	Describe, using a diagram, the essential components of an electrolytic cell.	2	The diagram should include the source of electric current and conductors, positive and negative electrodes, and the electrolyte.
9.5.2	State that oxidation occurs at the positive electrode (anode) and reduction occurs at the negative electrode (cathode).	1	
9.5.3	Describe how current is conducted in an electrolytic cell.	2	
9.5.4	Deduce the products of the electrolysis of a molten salt.	3	Half-equations showing the formation of products at each electrode will be

			assessed. **Aim 8:** This process (which required the discovery of electricity) has made it possible to obtain reactive metals such as aluminium from their ores. This in turn has enabled subsequent steps in engineering and technology that increase our quality of life. Unlike iron, aluminium is not prone to corrosion and is one material that is replacing iron in many of its applications.