Scheme of Work 2020 – 2021 (HT2) Subject: A2 Chemistry						
Year Group: 13 **Specification: AQA 7405**						
Lesson No	**Topic & Objectives**	**Big Question – What will students learn?**	**Key Activities & Specialist Terminology (Do Now Task / Starter/Tasks/Plenary**	**Planned Assessment**	**Homework or flipped learning resources** **DODDLE resources**	**Lit Num SMSC Codes**
3.1.11 Electrode potential and electrochemical cells	The idea of a cell that has a potential difference being made by combining two half cells (electrodes). How potentials are measured relative to the Standard Hydrogen Electrode and under standard conditions. Use the electrochemical series to calculate the EMF of cells and predict	**Students should be able to:** • understand that there is a potential difference between two half cells (electrodes) that are joined • use cell notation to represent cells • understand that potentials are measured relative to the Standard Hydrogen Electrode • understand that the potential of an electrode is affected by conditions • know the standard conditions under which potentials are measured know that electrode potential are listed in order in the electrochemical	• Students make simple cells and use them to measure EMF and unknown electrode potentials (AO2 - Apply knowledge and understanding; PS 1.1 - Solve problems set in practical contexts; AT j - Set up electrochemical cells and measuring voltages). • Students write the standard cell notation for cells (AO2 - Apply knowledge and understanding). • Students predict how changes in conditions will affect EMF (AO2 - Apply knowledge and understanding). • Students could be asked to plan and carry out an experiment to investigate the effect of changing conditions, such as concentration or temperature, in a voltaic cell such as $Zn\|Zn^{2+}\|\|Cu^{2+}\| Cu$ (AO2 - Apply knowledge and understanding; PS 1.1 - Solve problems set in practical contexts; PS 2.4 - Identify variables including those that must be controlled; AT j). Students could use *E* values to predict the direction of simple redox reactions, then test these predictions by simple test-tube reactions (AO2 - Apply knowledge)	• January 2013 Unit 5 Question 7 (QW13.5.07) • January 2012 Unit 5 Question 4 (QW12.5.04) • June 2006 Unit 5 Question 5 (QS06.5.05) • January 2004 Unit 5 Question 4 (QW04.5.04)	Nuffield Science Data Book (free download): http://www.nationalstemcentre.org.uk/elibrary/resource/3402/nuffield-advanced-science-book-of-data-second-edition Chemistry Data Book (Starck, Wallace, McGlashan) ISBN: 9780719539510 *Chemistry Review* articles: Understanding electrode potentials (Volume 12, edition 1) Electrode potentials (Volume 15, edition 3) Some suitable problems can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/	C3

	the direction of simple redox reactions. **Required practical 8** Measuring the EMF of an electrochemical cell.				(subscription required)	
3.1.11.2 Commercial applications of electrochemical cells	Cells can be used as a source of energy. Cells can be non-rechargeable or rechargeable Fuel cells can be used to generate an electric current. That there are benefits and risks associated with using these cells.	**Students should be able to:** • calculate the EMF and cell reaction for a commercial cell given the half-equations • explain how some cells can be recharged • explain how a hydrogen fuel cell works • Evaluate the benefits and risks associated with using non-rechargeable, rechargeable and fuel cells.	• Students make simple cells and use them to measure EMF and unknown electrode potentials (AO2 - Apply knowledge and understanding; PS 1.1 - Solve problems set in practical contexts). • Students write the standard cell notation for cells (AO2 - Apply knowledge and understanding). • Students predict how changes in conditions will affect EMF (AO2 - Apply knowledge and understanding). • Students could be asked to plan and carry out an experiment to investigate the effect of changing conditions, such as concentration or temperature, in a voltaic cell such as $Zn\|Zn^{2+}\|\|Cu^{2+}\| Cu$ (AO2 - Apply knowledge and understanding; PS 1.1 - Solve problems set in practical contexts; PS 2.4 - Identify variables including those that must be controlled). Students could use *E* values to predict the direction of simple redox reactions, then test these predictions by simple test-tube reactions (AO2 - Apply knowledge and understanding).	• June 2013 Unit 5 Question 5 (QS13.5.05) • June 2012 Unit 5 Question 5 (QS12.5.05) • January 2011 Unit 5 Question 5 (QW11.5.05)		

3.1.12 Acids and bases	The idea of acids as proton donors and bases as proton acceptors.	**Students should be able to:** • define Brønsted–Lowry acids and bases • identify species as Brønsted–Lowry acids or bases in proton transfer reactions.	• Identify which species acts as the acid and which as the base in Brønsted-Lowry acid-base reactions (AO2 - Apply knowledge and understanding).	• June 2012 Unit 4 Question 3a and 3b (QS12.4.03)	Theory of acids history websites: http://www.bbc.co.uk/dna/ptop/plain/A708257 http://pubs.acs.org/subscribe/archive/tcaw/12/i03/pdf/303chronicles.pdf RSC acid-base simulator: http://www.rsc.org/learn-chemistry/resource/res00001457/acid-base-solutions-rsc-funded	C3 C3
3.1.12.2 Definition and determination of pH	Calculate the pH of strong acids from concentration and vice versa.	**Students should be able to:** • calculate pH of a strong acid from its concentration • calculate the concentration of a strong acid from its pH • calculate the pH of when a strong acid is diluted.	• Identify acids as being strong or weak and monoprotic or diprotic (AO2 - Apply knowledge and understanding). • Calculate the pH of strong acids from the acid concentration, including examples where the acids are diluted (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Calculate the concentration of strong acids from the pH (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude).	• June 2009 Unit 4 Question 3a (QS09.4.03) •	RSC pH simulator: http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-simulation-rsc-funded Some suitable problems can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	C3

3.1.12.3 The ionic product of water K_w	Use K_w to calculate the pH of strong bases.	**Students should be able to:** • show that $K_w = [H^+][OH^-]$ • use K_w to find the pH of strong bases from its concentration, and vice versa • calculate the pH of water at different temperatures	• Derive the expression $K_w = [H^+][OH^-]$ (AO1 - Demonstrate knowledge and understanding). • Calculate the pH of strong bases from the base concentration and vice versa, including dilutions (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Calculate the pH of water at different temperatures (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Explain how the pH and neutrality of water is or is not affected by changes in temperature (AO2 - Apply knowledge and understanding).	• January 2013 Unit 4 Question 2a (QW13.4.02) • June 2011 Unit 4 Question 2a (QS11.4.02) • June 2010 Unit 4 Question 5a and 5b (QS10.4.05)	RSC pH simulator: http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-simulation-rsc-funded Some suitable problems can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	C3
3.1.12.4 Weak acids and bases; K_a for weak acids	Understand the term *weak* in relation to acids and bases. Use K_a to find the pH of weak acids from the concentration and vice versa.	**Students should be able to:** • write expressions for K_a for stated weak acids • perform calculations linking K_a to concentration and pH • convert K_a values to pK_a and vice versa • calculate the pH of water at different temperatures.	• Explain the difference between strong and weak acids and bases (AO1 - Demonstrate knowledge and understanding). • Derive expressions for K_a for stated acids (AO1 - Demonstrate knowledge and understanding). • Perform calculations linking K_a to concentration and pH (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude).	• January 2012 Unit 4 Question 4b (QW12.4.04) • January 2006 Unit 4 Question 2a and 2b (QW06.4.02)	RSC acid-base simulator: http://www.rsc.org/learn-chemistry/resource/res00001457/acid-base-solutions-rsc-funded RSC pH simulator: http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-simulation-rsc-funded	C3 C3

	Relate K_a to pK_a		• Convert K_a values to pK_a and vice versa, and use these values to rank acids in order of strength (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Measure K_a of a weak acid by measuring pH at half neutralisation (AO2 - Apply knowledge and understanding; AT c - Measure pH using pH charts, or pH meter, or pH probe on a data logger; PS 4.1 - Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques; AT d).		Creative problem solving in Chemistry – weak acids: http://www.rsc.org/learn-chemistry/resource/res00000677/a-weak-acid Some suitable problems can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	C3
3.1.12.5 pH curves, titrations and indicators	Calculate the pH of the solution formed when strong or weak acids react with strong bases. Sketch pH curves and choose suitable indicators for titrations. **Required practical 9** Investigate how pH	**Students should be able to:** • calculate pH of a mixture of a strong acid with a strong base • calculate the pH of a mixture of a weak acid with a strong base • sketch pH curves for titrations of strong/weak acids with strong/weak bases • choose a suitable indicator for acid-base titrations.	• Perform calculations to find the pH of mixtures of strong/weak acids with strong bases, with either excess acid or base (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Produce pH curves by experiment (AO2 - Apply knowledge and understanding; AT c - Measure pH using pH charts, or pH meter, or pH probe on a data logger; AT d, k, a). • Sketch pH curves for given acid and base combinations, and choose a suitable indicator (AO2 - Apply knowledge and understanding).	• June 2013 Unit 4 Question 3 (QS13.4.03) • June 2011 Unit 4 Question 1 (QS11.4.01) • CHEM4 Specimen Paper Question 3 (QSP 4.03) • June 2005 Unit 4 Question 2 (QS05.4.02) • June 2005 Unit 5 Question 2 (QS05.5.02) • June 2003 Unit 4 Question 3 (QW03.4.03)	RSC pH simulator: http://www.rsc.org/learn-chemistry/resource/res00001458/ph-scale-simulation-rsc-funded pH curve simulators: http://chem-ilp.net/labTechniques/AcidBaseIdicatorSimulation.htm http://terpconnect.umd.edu/~toh/models/TitrationDemo.html Some suitable problems can be found at http://www.docbrown.i	C3 C3

	changes when a weak acid reacts with a strong base and when a strong acid reacts with a weak base.				nfo/ and http://www.chemsheets.co.uk/ (subscription required)	
3.1.12.6 Buffer action	Know what buffer solutions are, how they are made and what they are used for. Explain how acidic and basic buffer solutions work. Calculate the pH of acidic buffer solutions.	**Students should be able to:** • describe what a buffer solution is and how it is made • explain qualitatively how acidic/basic buffer solutions work • know some uses of buffer solutions • calculate the pH of a buffer solution.	• Describe how buffer solutions are made, how they work and what they are used for (AO2 - Apply knowledge and understanding). • Calculate the pH of a buffer solution given details about quantities of the reagents it is made from, and changes in pH when small amounts of acid/alkali are added to buffer solutions (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude). • Students could prepare a solution of a specific pH and then test the solution to check its pH and buffer action (AO2 - Apply knowledge and understanding; MS0.4 - Use calculators to find and use power, exponential and logarithmic functions; MS2.5 - Use logarithms in relation to quantities that range over several orders of magnitude; AT c - Measure pH using pH charts, or pH meter, or pH probe on a data logger; AT e - Use volumetric flask, including accurate	• January 2013 Unit 4 Question 2 (QW13.4.02) • January 2011 Unit 4 Question 2 (QW11.4.02) • CHEM4 Specimen Paper Question 4 (QSP 4.04) • January 2005 Unit 4 Question 8 (QW05.4.08) • January 2002 Unit 4 Question 3 (QW02.4.03)	Sandcastles & mudhuts – buffering action in blood (Hancock) ISBN 9780340543696 Some suitable problems can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	

			technique for making up a standard solution; PS 1.1 - Solve problems set in practical contexts; PS 4.1 - Know and understand how to use a wide range of experimental and practical instruments, equipment and techniques).			
3.2.4 Properties of Period 3 elements and their oxides	Reactions of Na and Mg with water. Reactions of Na, Mg, Al, Si, P and S with oxygen. Melting points of period 3 oxides. Reactions of period 3 oxides with water.	**Students should be able to:** • describe and write equations for reactions of Na and Mg with water • describe and write equations for reactions of Na, Mg, Al, Si, P and S with oxygen • describe and explain the trend in melting points of period 3 oxides • write equations for the reactions of period 3 oxides with water and describe the pH of the solutions formed describe the structure and bonding of period 3 oxides, and link this to how they react with water.	• Practical opportunity: react specified period 3 elements with water and oxygen; react specified oxides with water. • Plot a graph of melting points of period 3 oxides and annotate it with explanation of the relative melting points. • Complete tables including equations to show how period 3 elements react with water and/or oxygen, and how period 3 oxides react with water.	• June 2013 Unit 5 Question 4a, 4b and 4c (QS13.5.04) • January 2013 Unit 5 Question 4a, 4b, 4c and 4d (QW13.5.04) • January 2012 Unit 5 Question 3 (QW12.5.03) • January 2011 Unit 5 Question 3 (QW11.5.03)	Youtube video on Period 3 oxides: https://www.youtube.com/watch?v=D0pNAFjyE6o Youtube video of reaction of phosphorus with oxygen: https://www.youtube.com/watch?v=U6_-EUcswSc&src_vid=mjkuSm__G7s&feature=iv&annotation_id=annotation_323593	C3 C3