Scheme of Work 2020 – 2021 (HT1)
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
1	- 3.1.4 – Energetics Definitions of enthalpy changes used in Born–Haber and solution enthalpy cycles. Using Born–Haber cycles for ionic compounds. Considering covalent character of ionic compounds. Using solution enthalpy cycles for ionic compounds.	**Students should be able to:** • define lattice enthalpy (formation and dissociation), enthalpy of formation, ionisation enthalpy, enthalpy of atomisation, bond enthalpy, electron affinity, enthalpy of solution, hydration enthalpy • draw and use Born–Haber cycles to find missing values of enthalpy changes • Comment on the covalent character of an ionic compound by comparing lattice enthalpies found using Born–Haber cycles with those calculated theoretically using the perfect ionic model.	• Write equations to represent enthalpy changes (AO2 - Apply knowledge and understanding). • Construct Born-Haber cycles and use them to calculate missing enthalpy change values (AO2 - Apply knowledge and understanding; MS2.2 Change the subject of an equation). • Compare and comment on values of enthalpy changes from Born–Haber cycles with those calculated theoretically using the perfect ionic model (AO3 - Analyse, interpret and evaluate data to make judgements). • Construct and use cycles involving the solution of ionic compounds in water to find missing enthalpy change values (AO2 - Apply knowledge and understanding MS2.2 Change the subject of an equation). • Rich question – predict the relative magnitude of the lattice enthalpy of the following compounds: aluminium oxide, potassium oxide, sodium chloride, sodium oxide. Rich question – for an ionic compound with covalent character, deduce whether the lattice enthalpy will have a greater or smaller	• June 2013 Unit 5 Question 1 (QS13.5.01) • June 2013 Unit 5 Question 2 (QS13.5.02) • January 2013 Unit 5 Question 2 (QW13.5.02) • June 2011 Unit 5 Question 1 (QS11.5.01) • January 2010 Unit 5 Question 4 (QW10.5.04)	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 Many suitable calculations can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	

			magnitude than that calculated theoretically from the perfect ionic model.			
2	3.1.8.2 Gibbs free-energy change ΔG and entropy change ΔS	**Students should be able to:** • describe entropy in terms of disorder • predict whether reactions have an increase or decrease in entropy • calculate the entropy change for a reaction • calculate the Gibbs free-energy change for a reaction at a given temperature • determine whether a reaction is feasible at a given temperature • calculate the temperature at which a reaction becomes feasible • use entropy changes to explain why some endothermic reactions are feasible.	• Rank given substances in terms of entropy (AO2 - Apply knowledge and understanding). • Use entropy values to calculate the entropy change for a reaction (AO2 - Apply knowledge and understanding MS2.2 Change the subject of an equation; MS2.3 Substitute numerical values into algebraic equations). • Predict, where possible, whether reactions have an increase or decrease in entropy (AO2 - Apply knowledge and understanding). • Use the equation $\Delta G = \Delta H - T\Delta S$ to determine whether reactions are feasible at given temperatures, and determine the temperature at which reactions become feasible (AO2 - Apply knowledge and understanding; MS2.2 - Change the subject of an equation; MS2.3 - Substitute numerical values into algebraic equations using appropriate units for physical quantities). • Plot graphs of ΔG versus T to determine ΔH and ΔS (MS3.3 - Determine the slope and intercept ofa linear graph). • Forecast how temperature affects the feasibility of reactions given the sign of the enthalpy and entropy changes (AO2 - Apply knowledge and understanding). • Apply the equation $\Delta G = \Delta H - T\Delta S$ to state changes to find ΔH, ΔS, melting and/or boiling points (AO2 - Apply knowledge and understanding; MS2.2 - Change the subject of an equation; MS2.3 - Substitute numerical values into	• June 2013 Unit 5 Question 3 (QS13.5.03) • January 2012 Unit 5 Question 2 (QW12.5.02) • June 2011 Unit 5 Question 2 (QS11.5.02) • June 2010 Unit 5 Question 6 (QS10.5.06)	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 RSC Classic Chemical Demonstrations - ΔH and ΔS for the vaporization of water using a kettle http://media.rsc.org/Classic%20Chem%20Demos/CCD-57.pdf Many suitable calculations can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/	C3

			algebraic equations using appropriate units for physical quantities). Determine ΔH and ΔS for the vaporization of water using a kettle (PS 3.2 - Process and analyse data using appropriate mathematical skills as exemplified in the mathematical appendix for each science).			
3	**3.1.9.1 Rate equations** Understand rate equations and order of reaction. Deduce order of reaction, rate equations and rate constants from rate data. Describe how the rate constant changes with temperature. Use the Arrhenius equation.	**Students should be able to:** • define the terms order of reaction and rate constant • describe how changing concentration of a reagent affects the rate when the order with respect that reagent is 0, 1 or 2 • determine the values and units for rate constants given appropriate data • describe how rate constants change with temperature • perform calculations using the Arrhenius equation plot straight line graphs of ln k versus 1/T to determine the activation energy of a reaction.	• Describe how changes in concentration will affect reaction rates given the rate equation (AO2 - Apply knowledge and understanding). • Use rate equations to determine reaction rates or rate constants (with units) using initial rate data (AO2 - Apply knowledge and understanding; MS0.0 - Recognise and make use of appropriate units in calculation; MS2.3 – substitute numerical values into algebraic equations; MS2.4 - Solve algebraic equations). • Students use a graph of concentration–time and calculate the rate constant of a zero-order reaction by determination of the gradient. (AO2 - Apply knowledge and understanding; MS3.3 - Determine the slope of a linear graph; MS3.4 - Calculate rate of change from a graph showing a linear relationship). Students can measure the activation energy for the catalysed and uncatalysed reaction of iodine with peroxodisulphate(VI) ions by experiment and plotting graphs (AO2 - Apply knowledge and understanding; MS3.3 - Determine the slope of a linear graph).	• June 2006 Unit 4 Question 5a and 5b (QS06.4.05) • June 2003 Unit 4 Question 1 (QS03.4.01)	Calculations in AS / A Level Chemistry (Clark) ISBN 9780582411272 *Chemistry Review* article: Establishing a rate equation (Volume 14, edition 2) Many suitable calculations can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ Advanced PracticalChemistry (ILPAC) ISBN 0719575079	C3

4	**3.1.9.2 Determination of rate equation** Understand that rate equations have to be determined by experiment. Link rate equations to mechanisms. Determine rate using concentration-time graphs. Use rate-concentration graphs to deduce order for a reagent. **Required practical 7** Measure the rate of a reaction by an initial rate method, and a continuous monitoring method.	**Students should be able to:** • explain that rate equations can only be determined by experiment • use concentration-time graphs to find rates (including initial rates) • use initial rate data to determine rate equations • use rate-concentration data/graphs to find orders of reaction with respect to a reagent link rate equations to mechanism and determine rate determining steps.	• Determine rate equations, rate constants (with units) using initial rate data (AO2 - Apply knowledge and understanding; MS0.0 - Recognise and make use of appropriate units in calculation; MS2.3 – substitute numerical values into algebraic equations; MS2.4 - Solve algebraic equations). • Students do the iodine clock reaction and determine the order of reaction for a reactant (AO2 - Apply knowledge and understanding; PS 2.4 - Identify variables including those that must be controlled; PS 3.1 - Plot and interpret graphs; PS 3.2 - Process and analyse data using appropriate mathematical skills; MS3.1 - Translate information between graphical, numerical and algebraic forms; MS3.2 - Plot two variables from experimental or other data; MS3.3 - Determine the slope and intercept of a linear graph AT a, k, l). • Students can react calcium carbonate or magnesium with acid of different concentrations and plot volume of gas formed against timerates could be found from these plots and compared (AO2 - Apply knowledge and understanding; PS 2.4 - Identify variables including those that must be controlled; PS 3.1 - Plot and interpret graphs; PS 3.2 - Process and analyse data using appropriate mathematical skills; MS3.1 - Translate information between graphical, numerical and algebraic forms; MS3.2 - Plot two variables from experimental or other data; MS3.3 - Determine the slope and intercept of a linear graph; MS3.4 - Calculate rate of change from a graph showing a linear relationship; MS3.5 - Draw and use the	• SAM A-level paper 2 (set 1) Q2 • June 2013 Unit 4 Question 1 (QS13.4.01) • January 2013 Unit 4 Question 1 (QW13.4.01) • January 2011 Unit 4 Question 1 (QW11.4.01) • January 2010 Unit 4 Question 3 (QW10.4.03) • January 2006 Unit 4 Question 1 (QW06.4.01) • January 2003 Unit 4 Question 1 (QW03.4.01)	Calculations in AS / A Level Chemistry (Clark) ISBN 9780582411272 *Chemistry Review* article: Establishing a rate equation (Volume 14, edition 2) ILPAC Unit P5: Chemical Kinetics (free download from www.nationalstemcentre.org.uk) Avogadro web site on rate equations: http://www.avogadro.co.uk/kinetics/rate_equation.htm	 C3 C3 C3

			slope of a tangent to a curve as a measure of rate of change; AT a, k, l). • Students can use colorimetry for continuous monitoring experiments (eg bromine + methanoic acid; propanone + iodine) to determine order (AO2 - Apply knowledge and understanding; PS 3.1 - Plot and interpret graphs; PS 3.2 - Process and analyse data using appropriate mathematical skills; MS3.1 - Translate information between graphical, numerical and algebraic forms; MS3.2 - Plot two variables from experimental or other data; MS3.3 - Determine the slope and intercept of a linear graph; MS3.4 - Calculate rate of change from a graph showing a linear relationship; MS3.5 - Draw and use the slope of a tangent to a curve as a measure of rate of change; AT a, k, l). • Students could be given data to plot and interpret in terms of order with respect to a reactant. Alternatively, students could just be given appropriate graphs and asked to derive order(s) (AO2 - Apply knowledge and understanding; MS3.1 - Translate information between graphical, numerical and algebraic forms; MS3.2 - Plot two variables from experimental or other data; MS3.3 - Determine the slope and intercept of a linear graph; MS3.4 - Calculate rate of change from a graph showing a linear relationship; MS3.5 - Draw and use the slope of a tangent to a curve as a measure of rate of change). • Students calculate the rate constant of a zero-order reaction by determining the gradient of a concentration–time graph (MS3.3 - Determine the slope and intercept of a linear graph; MS3.4 -			

			Calculate rate of change from a graph showing a linear relationship). Students plot concentration–time graphs from collected or supplied data and draw an appropriate best-fit curve. Students draw tangents to such curves to deduce rates at different times (MS3.5 - Draw and use the slope of a tangent to a curve as a measure of rate of change).			
6	3.1.6 – Chemical equilibria, Le Châtelier's principle and K_c Understand the concept of and calculate partial pressures using mole fractions. Write expressions for and calculate K_p including units. Perform calculations involving K_p. Predict how changes in conditions affect the	**Students should be able to:** • calculate equilibrium quantities, mole fractions and partial pressures for equilibrium mixtures • write an expression for K_p for a reaction and calculate the value of K_p with units • predict and justify how changes in temperature and pressure affect the position of an equilibrium, and how this may or may not affect the value of K_p understand how a catalyst affects an equilibrium and the value of K_p.	• Given initial amounts of substances and one substance at equilibrium, find the quantity of each reagent at equilibrium (AO2 - Apply knowledge and understanding). • Calculate mole fractions and then partial pressures in order to determine K_p, with units (AO2 - Apply knowledge and understanding; MS2.3 - Substitute numerical values into algebraic equations using appropriate units for physical quantities). For given equilibria with enthalpy change data, predict the effect on the position of an equilibrium and the value of K_p (AO2 - Apply knowledge and understanding).	• January 2007 Unit 4 Question 2 (QW04.4.02) • June 2007 Unit 4 Question 1 (QS07.4.01) • January 2008 Unit 4 Question 3 (QW08.4.03) • June 2008 Unit 4 Question 3 (QS08.4.03) • January 2009 Unit 4 Question 3 (QW09.4.03) June 2009 Unit 4 Question 2 (QS09.4.02)	Calculations for A level Chemistry (Ramsden) ISBN 9780748758395 Many suitable calculations can be found at http://www.docbrown.info/ and http://www.chemsheets.co.uk/ (subscription required)	

	position of an equilibrium and the value of K_p. The effect of a catalyst affects an equilibrium and K_p.					