Scheme of Work 2020 – 2021 (HT3+4)
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
3.2.5 Transition metals	Give the electron structure of transition metals and their ions. Know the characteristic properties of transition metals. Understand the terms complex, ligand co-ordinate bond, and co-ordination number.	**Students should be able to:** • write the electron structure of first row transition metals and their ions • describe what a transition metal is in terms of electron structure • describe the characteristic properties of transition metals define the terms ligand, complex, co-ordinate bond and co-ordination number	• State the electron structure of first row transition metals and their ions (AO1 - Demonstrate knowledge and understanding). • Explain why the elements Ti–Cu have properties characteristic of transition metals, and what those characteristics are (AO1 - Demonstrate knowledge and understanding). • Identify the oxidation state of the metal, the ligands and co-ordination number in a series of complexes (AO2 - Apply knowledge and understanding). Identify an element from the series Ti–Cu and find examples for that element to confirm its characteristic properties (AO3 - Analyse, interpret and evaluate scientific information, ideas and evidence).	• January 2005 Unit 5 Question 6a (QW05.5.06) • June 2010 Unit 5 Question 4a and 4b (QS10.5.06) • January 2011 Unit 5 Question 4a and 4b (QW11.5.04)	*Chemistry Review* article: Vanadium (Volume 19, edition 4)	C3
3.3.9.2 Acylation	Draw the structure of and name acid anhydrides,	**Students should be able to:** • draw the structure of and name acid anhydrides,	• Students draw and name acid anhydrides, acyl chlorides and amides (AO2 - Apply knowledge and understanding). • Students write equations and outline mechanisms for acylation reactions of	• January 2012 Unit 4 Question 10a (QW12.4.10)	RSC resource on aspirin: http://www.rsc.org/learn-chemistry/resource/res00000056/aspirin	C3

	acyl chlorides and amides. Understand acylation reactions of water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides, including the mechanism for acyl chlorides. **Required practical 10** Preparation of - a pure organic solid and test of its purity - a pure organic liquid.	acyl chlorides and amides • identify the products of and write equations for acylation reactions of water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides • outline the mechanism for the acylation reactions of acyl chlorides • state advantages of using ethanoic anhydride rather than ethanoyl chloride in the production of aspirin • prepare and purity an organic solid and test its purity.	water, alcohols, ammonia and amines with acyl chlorides and acid anhydrides; some of these reactions could be demonstrated. Students prepare, purify and test the purity of aspirin by melting point determination (AO2 - Apply knowledge and understanding; AT d - Use laboratory apparatus for a variety of experimental techniques including distillation and heating under reflux, including setting up glassware using retort stand and clamps; AT d - Use laboratory apparatus for a variety of experimental techniques including filtration, including use of fluted filter paper, or filtration under reduced pressure; AT k.	• June 2006 Unit 4 Question 1 (QS06.4.01) • June 2005 Unit 4 Question 7 (QS05.4.07) • June 2003 Unit 5 Question 8b (QS03.5.08)	Aspirin Pre-lab Screen Experiment: http://www.rsc.org/learn-chemistry/resource/res00001644/aspirin-screen-experiment RSC mechanisms resource: http://www.rsc.org/learn-chemistry/resource/res00000638/curly-arrows-and-stereoselectivity-in-organic-reactions Mechanism animations http://science.jbpub.com/organic/movies/	C3 C3 C3

3.3.10 Aromatic Chemistry	Understand the structure of benzene and evidence for delocalisation.	**to:** • describe the structure of benzene and explain how delocalisation makes benzene more stable than the theoretical cyclohexa-1,3,5-triene • use thermochemical evidence from enthalpies of hydrogenation to account for this extra stability • explain why benzene undergoes substitution reactions in preference to addition reactions.	• Name a range of aromatic compounds with common functional groups (AO2 - Apply knowledge and understanding). • Draw enthalpy diagrams to show the relative stability of cyclohexane, cyclohexene, cyclohexa-1,4-diene, benzene and the theoretical cyclohexa-1,3,5-triene (AO2 - Apply knowledge and understanding).	• June 2011 Unit 4 Question 8a (QS11.4.08) • January 2004 Unit 4 Question 7a (QW04.4.07)	*Chemistry Review* article: The structure of benzene (Volume 1, edition 1) *Chemistry Review* article: Who discovered the structure of benzene (Volume 5, edition 1)	C3 C3
3.3.13 Amino acids, proteins and DNA	Understand the structure of amino acids. Draw the structure of given amino acids in acidic solution, alkaline solution and as zwitterions.	**Students should be able to:** • draw the structure of given amino acids in acidic solution, alkaline solution and as zwitterions.	• Given the structure of the amino acid, students show draw the structure of the species formed in acidic solution, alkaline solution and as a zwitterion (AO2 - Apply knowledge and understanding).	• June 2013 Unit 4 Question 6 (QS13.4.06) • January 2012 Unit 4 Question 7 (QS12.4.07) • January 2005 Unit 4 Question 2 (QW05.4.02)	Structure of amino acids (rotatable) https://undergrad-ed.chemistry.ohio-state.edu/jmol-viewer/# RSC resource on basic biochemistry http://www.rsc.org/Education/Teachers/Resources/cfb/proteins.htm	C3 C3
3.3.13.2 Proteins	Understand the structure of proteins.	**to:** • describe the primary, secondary and tertiary structure of proteins, including the importance	• Draw the structure of peptides formed from joining amino acids together (AO2 - Apply knowledge and understanding).	• January 2010 Unit 4 Question 6 (QW10.4.06)	Structure of amino acids and proteins (rotatable) https://undergrad-ed.chemistry.ohio-state.edu/jmol-viewer/#	C3

	Understand how peptide links can be hydrolysed to release amino acids. Know how to use thin-layer chromatography to separate and identify amino acids.	of hydrogen bonds and S-S bonds • draw the structure of peptides formed from amino acids • know that peptide link can be hydrolysed producing amino acids • identify the amino acids given when a peptide is hydrolysed • know that amino acids can be separated and identified by thin-layer chromatography, including the use of R_f values.	• Identify amino acids formed when peptides are hydrolysed (AO2 - Apply knowledge and understanding). • Identify the primary, secondary and tertiary parts of the structure of some proteins (AO2 - Apply knowledge and understanding). • Students can carry out some thin-layer chromatography of some amino acids to identify an unknown amino acid (AO2 - Apply knowledge and understanding; AT i - Use thin-layer or paper chromatography).	• SAM A level Paper 2 Questions 5 • June 2011 Unit 4 Question 4c (QS11.4.04) • January 2011 Unit 4 Question 4f (QW11.4.04)	RSC resource on basic biochemistry http://www.rsc.org/Education/Teachers/Resources/cfb/proteins.htm AQA Biochemistry Teachers' Notes (covers 3.3.13): http://www.aqa.org.uk/resources/science/as-and-a-level/chemistry-7404-7405/teach/teaching-notes	C3
3.3.13.3 Enzymes	Understand the structure of enzymes. Understand the action of enzymes in terms of active sites. Understand the principle of drug action and the use of computer aided design.	**Students should be able to:** • explain that enzymes are proteins which act through a stereospecific active site that binds to a substrate • explain how drugs, which can be designed with the aid of computers, can act to inhibit enzymes by blocking active sites, but that the correct enantiomer is required.	• Use a right handed glove with their right/left hands to model enzyme action (AO2 - Apply knowledge and understanding).		RSC resource on basic biochemistry of enzymes http://www.rsc.org/Education/Teachers/Resources/cfb/enzymes.htm Useful animations on action of enzymes (eg hydrolysis of sucrose) http://doctorprodigious.wordpress.com/hd-animations/	C3 C3

3.3.13.4 DNA	Understand the structure of the components of DNA (given on data sheet). Understand the nature of nucleotides. Understand the structure of single DNA strands and the arrangement of these together in the double helix structure.	**Students should be able to:** • identify the components of DNA • explain how the two DNA strands interact with hydrogen bonds between base pairs.	• Make a 2D or 3D model of DNA using cut out components (AO2 - Apply knowledge and understanding). • Label a diagram of DNA to show the components and the hydrogen bonding between base pairs (AO1 - Demonstrate knowledge and understanding of scientific ideas).	• SAM A-level Paper 2 (set 1) Question 8	How Stuff Works on the structure of DNA http://science.howstuffworks.com/life/cellular-microscopic/dna1.htm Simple animation showing the structure of DNA: http://www.youtube.com/watch?v=qy8dk5iS1f0 Useful animations on biochemistry http://doctorprodigious.wordpress.com/hd-animations/ *Chemistry review* article: Why is DNA helical? (Volume 1, edition 1)	C3 C3 C3 C3
3.3.13.5 Action of anti-cancer drugs	Understand how DNA replicates and how anti-cancer drug cisplatin prevents this.	**Students should be able to:** • describe how DNA replicates in simple terms • explain how the anti-cancer drug cisplatin prevents DNA replication • explain why some drugs can have adverse effects and appreciate the balance between benefits and adverse effects of any drug.	• Write notes to accompany a sequence of diagrams showing DNA replication (AO1 - Demonstrate knowledge and understanding of scientific ideas). • Write notes to accompany a diagram showing the action of cisplatin (AO1 - Demonstrate knowledge and understanding of scientific ideas). • Evaluate the benefits and adverse effects of using drugs such as cisplatin (AO3 - Analyse, interpret and evaluate scientific information).	• SAM A-level Paper 2 (set 1) Question 8	Useful animations on biochemistry (DNA replication) http://doctorprodigious.wordpress.com/hd-animations/ Youtube video on action of cisplatin http://www.youtube.com/watch?v=Wq_up2uQRDo	C3 C3

					Cisplatin – molecule of the month http://www.chm.bris.ac.uk/motm/cisplatin/htmlonly/ *Chemistry review* article: Metals in medicine (Volume 8, edition 2) *Chemistry review* article: Curing cancer with chemistry (Volume 18, edition 3 *Chemistry review* article: Cisplatin: from accidental discovery to wonder drug (Volume 21, edition 4)	C3 C3 C3 C3

3.3.14 Organic synthesis	Devise synthetic routes to make specified compounds	**Students should be able to:** • devise synthetic routes, with up to four steps, to make specific organic compounds using the reactions in the specification • explain why processes are designed to avoid solvents, non-hazardous starting materials and have steps with high atom economy.	• Devise synthetic routes, including reaction conditions, to make organic compounds using reactions in the specification (AO2 - Apply knowledge and understanding). • Describe features of processes that improve sustainability (A03 - Analyse, interpret and evaluate scientific information).	• Specimen Paper CHM4 Question 8 (QSP.4.08) • Specimen Paper CHM4 Question 9 (QSP.4.09) • June 2006 Unit 4 Question 6 (QS06.4.06) • January 2003 Unit 4 Question 7 (QW03.4.07) • June 2002 Unit 4 Question 7 (QS02.4.07)	RSC synthesis resource http://www.rsc.org/learn-chemistry/resource/res00000003/synthesis-explorer *Chemistry review* article: New tricks for stacking bricks: modern approaches to organic synthesis (Volume 12, edition 3) *Chemistry review* article: Salbutamol: saving your breath (Volume 18, edition 4)	C3 C3 C3

3.3.15 Nuclear magnetic resonance spectroscopy	Using ^{1}H and ^{13}C NMR to deduce information about the structure of organic molecules. Understand similarities and differences between ^{1}H and ^{13}C NMR. Understand the use of TMS and suitable solvents.	**Students should be able to:** • understand the use of TMS and the δ scale for chemical shift • understand the use of deuterated solvents or CCl_4 • use the n+1 rule to deduce spin-spin splitting patterns of adjacent, non-equivalent protons in aliphatic compounds • deduce the structure of compounds using ^{1}H NMR to deduce structures including the number, position, relative intensity and splitting of signals deduce the structure of compounds using ^{13}C NMR to deduce structures including the number and position of signals	• Predict the number, position, relative intensity and splitting of signals in the ^{1}H NMR spectrum of compounds (AO2 - Apply knowledge and understanding). • Predict the number and position of signals in the ^{13}C NMR spectrum of compounds (AO2 - Apply knowledge and understanding). • Use data from NMR, and other analytical methods on the specification, to deduce the structure of compounds (AO2 - Apply knowledge and understanding; MS3.1 Translate information between graphical, numerical and algebraic forms).	• June 2013 Unit 4 Question 7 (QS13.4.07) • January 2013 Unit 4 Question 5 (QS13.4.05) • June 2012 Unit 4 Question 8 (QS12.4.08) • January 2011 Unit 4 Question 5 (QW11.4.05) • January 2003 Unit 4 Question 5 (QW03.4.05) • January 2002 Unit 4 Question 4 (QW02.4.04)	RSC Spectral School: http://www.rsc.org/learn-chemistry/collections/spectroscopy?uol_r=3ae0be55 RSC Spectroscopy resource: http://www.rsc.org/learn-chemistry/resource/res00000847/spectroscopy Database of spectra for organic compounds http://sdbs.db.aist.go.jp/sdbs/cgi-bin/cre_index.cgi CLEAPSS Spectra (Secondary Science Guide L202) http://www.cleapss.org.uk/secondary/secondary-science/secondary-science-guides?start=20 (Subscription required)	C3 C3

3.3.16 Chromatography	Describe the similarities and differences between thin-layer, column and gas chromatography. Explain how chromatography works. Use chromatography to separate and identify substances. **Required practical 12** Separation of species by thin-layer chromatography	**Students should be able to:** • describe the similarities and differences between thin-layer, column and gas chromatography • explain how chromatography works • use retention times and R_f values to identify substances describe the use of mass spectroscopy to analyse substances separated by gas chromatography.	• Produce a summary to compare similarities and differences between thin-layer, column and gas chromatography (AO1 - Demonstrate knowledge and understanding of scientific ideas). • Separate mixtures and identify substances (eg amino acids) by thin-layer chromatography (AO2 - Apply knowledge and understanding; AT i - Use thin-layer or paper chromatography). • Use retention time and R_f data to identify substances separated by chromatography.	• January 2011 Unit 4 Question 4f (QW11.4.04)	AQA Chromatography Teachers' Notes: http://filestore.aqa.org.uk/resources/chemistry/AQA-7405-TN-CHROMATOGRAPHY.PDF RCS video on TLC http://www.rsc.org/learn-chemistry/resource/res00001074/thin-layer-chromatography Modern Chemical Techniques RSC resource: http://www.rsc.org/learn-chemistry/resource/res00001301/chromatography *Chemistry Review* articles: How pure is your aspirin? (Volume 6, edition 3) What is chromatography? (Volume 8, edition 2) Antarctic atmospheric chemistry (Volume 13, edition 2)	C3 C3 C3 C3 C3

					Drugs on money (Volume 13, edition 4) Thin-layer chromatography (Volume 14, edition 3) Body oddities: the chemical reactions of eating (Volume 21, edition 1) Body oddities: the chemical reactions of eating (Volume21, edition 4)	C3 C3 C3 C3