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| **Term**  | **INTENT** | **IMPLEMENTATION** | **IMPACT**  |
| **Substantive Knowledge**This is the specific, factual content for the topic, which should be connected into a careful sequence of learning. | **Disciplinary Knowledge (Skills)**This is the action taken within a particular topic in order to gain substantive knowledge. | **Assessment opportunities**What assessments will be used to measure student progress?Evidence of how well students have learned the intended content. |
|  | **Week 1.**5.1.1 and 6.1.1 (in parallel) | * Order, rate equations and rate constant (5.1.1). It is essential to discuss how the order of the reaction can be derived from numerical data provided, to show how and if any reagents in the reaction influence the rate.
* Benzene 6.1.1 and 6.1.2
* Naming aromatic compounds
* The idea of structure and reactions of benzene (The Arenes) are discussed and discrepancies relating to the structure proposed by Kekule. Need to discuss why scientists have moved away from the proposed Kekule structure and that the p-orbital ALL ‘side-overlap’, hence forming a ‘delocalised’ area of pi-electrons.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics. |
|  **In module 5.1, Rate of reactions studied in year 13 are an extension of what has already been covered in GCSE and indeed in year 12. Here we study the factors influencing rates but extend the idea of deriving the rate determining steps as well as order of reactions from data and the rate equation.****In Module 6, we start with ‘Aromatic Organic’ chemistry and introduction to a ‘new’ unsaturated compound and the idea of ‘electrophilic substitution’.** |
|  | **Week 2****5.1.2, 5.1.3 and 6.1.4** | Concentration time graph (5.1.2)* Electrophilic reactions 6.1.3 and 6.1.4. It is essential that in these reactions the role of the catalysts, in formation of the ‘electrophile’, is discussed first. Positively charged species that are then attacked by electrons from the delocalised rings.
* Friedel-Craft
* Electrophilic substitution of benzene to form nitro benzene as well as alky benzene and halo arenes are discussed, with particular attention to the reaction mechanism.
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|  **In module 5 we continue to develop the idea of factors influencing rates of reaction.****In aromatic synthesis we extend the idea to how electrophilic substitution takes place, with emphasis on reaction mechanism.** |
|  | **Week 3****5.1.3, 6.1.5 and 6.1.6** | * Rate-concentration graph (5.1.3). The relationship between Rate of reaction and concentration is shown and appropriate questions are prepared and discussed with students.
* Phenols. These compounds with an OH functional group directly attached to the ring are discussed and a comparison with the reactivity of the arenes discussed, and in a well-planned approached its higher order of reactivity and the reason explained.
* Electrophilic substitution
* Reaction of phenolic compounds in comparison to the arenes (benzene) will be discussed. Here the higher order of reactivity of phenols due to delocalisation of electrons into the ring is discussed.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on.Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
|  **Organic synthesis is further extended with the study of phenols. Here we explore why phenols are more reactive, which is due to higher electron density in the ring, as a direct consequence of delocalisation of electrons from the lone pairs on oxygen. This is extended to comparison of reactions between the arenes and phenols** |
|  | **Week 4**5.1.4 and 6.1.7 and 6.1.8 | * Rate determining step (5.1.4). Here the influence of each of the reagents is studied and the steps (slow step\_, identified as the rate determining step, i.e. a reaction that unless it takes place the whole reaction will not proceed to completion.
* Reaction of carbonyl compounds. The pivotal role of the compounds with the carbonyl functional group (C=O), is discussed, where ethe delta +Ve carbon is attacked by nucleophiles.
* Tests for carbonyl compounds
* Carbonyl compounds, either in aldehydes or ketones are identified by Brady’s reagent (acidified 2,4, DNPH)
* Identification of Aldehydes is discussed via ammoniacal AgNO3 (the silver mirror test)
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **Continuing with module 5, Rate determining step (the slow step in reactions) is discussed. Here many questions will be provided for students to practice.****In module 6 organic reactions are now extended to nucleophilic addition reactions and the role of the (polar) carbonyl functional group.****Furthermore, discussing as to how aldehydes and ketones, both having the carbonyl functional groups can be identified.** |
|  | **Week 5****5.1.5, 6.1.9 and 6.1.10** | * Effect of temperature on Kc (5.1.5). How temperature can affect the value of Kc is discussed, by goining through various worked-examples as well as timed questions.
* Carboxylic acids, as weak and partially ionisable acids are discussed and the their role in reactions and preparation of buffer solutions discussed and developed.
* Esters
* Carboxylic acids, as weak acids undergoing partial ionisation is discussed. Reactions of carboxylic acids, is e.g. preparation of esters and amides are discussed.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
| **In module 5, the expression and the units of Kc, as well as factors influencing its value is discussed and backed up by worked as well as timed and challenging questions.****In Module 6 physical and chemical properties of carboxylic acids is discussed.** |
|  | **Week 6**5.1.6 and 6.1.11 and 6.2.1 | * Equilibrium (5.1.6). This topic is an extension of previous learning at KS4, discussing the factors influencing the position of the equilibria in chemical reactions.
* Acyl chlorides. An extension to the study of carboxylic acids, Acyl Chlorides are prepared by chlorinating agents such as SOCl2, as the more reactive, alternatives to carboxylic acids.
* Amines and basicity (6.2.1). The idea of basic compounds are extended to Amines and Amides and their preparation and reactions are discussed in detail.
* Preparation of Amines as basic compounds via reactions of haloalkanes with ammonia, to produce primary amines , is discussed.
* Preparation of secondary and tertiary amines are also discussed.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5, further extension to the idea of equilibria, is discussed, which is an extension of the idea already embed during KS4.****In module 6, Nitrogen-containing compounds (Amine and Amides), their properties and preparation are discussed. This might be considered as the extension to the preparation** **of Ammonia (the Haber process), students studied at GCSE.** |
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|  | **Week 7**PAG and Mini Test 1  | Practical assessment (PAG) as well as scheduled first test on all topics covered in 6.1 |  |
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|  | **Week 8****Test and 6.2.2 and 6.2.3** | Mini Test on 5.1.1- 5.1.6* Amino acids
* Amides
* Preparation of Amides from reaction of acyl chlorides or carboxylic acids with amines is discussed.
* The idea of optical isomerism is introduced by reflecting on Alpha amino acid structures.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **Studying Amino acids has many benefits. It allows us to further discuss basicity. It is also an extension of work on Amines and amides. However, most importantly it enables us to discuss the idea of ‘Chiral carbon’, and hence ‘optical’ isomerism, in Alpha Amino Acids. It also allows us to discuss condensation polymerisations.**  |
|  | **Week 9****5.1.7 and 6.2.4 and 6.2.5** | * Equilibrium and Kp (5.1.7). Like Kc the effect of reacting gases in the reaction mixture is studied.
* Chirality. Here by introducing the idea of chirality or the chiral centre, we embark on its pivotal role in formation of optical isomerism in organic compounds. Example of organic molecules with chiral centre(s) can be discussed or presented as timed questions.
* Condensation reactions
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
|  **In module 5, Kc is now extended to the idea of Kp, where the reacting species are gases, in confined containers and under pressure.****In module 6 the idea of condensation polymerisation’ is extended, to for instance encompass ‘polyamides’, i.e. Nylons.** |
|  | **Week 10****5.1.8 and 6.2.6 and 6.2.7** | * Kc and its significance (5.1.8)
* Hydrolysis of amides and esters to reform the reagents they were made from is discussed in detailed reaction mechanism. The idea is introduced as the reverse of condensation reactions. Bothe acid hydrolysis as well as alkali hydrolysis is needed to be discussed in detail.
* Extension of C length
* Nucleophilic addition, whether the hydride ion or the cyanide, is discussed and the reaction mechanism shown.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **Kc revisited in module 5 with extended ideas.****In module 6 idea of nucleophilic addition, using Hydride ions and Cyanide (Nitrile) ions is discussed.****The significance of CN addition is in ‘addition of an extra Carbon’ to the chain. However, CN functional group is also important as its reduction leads to formation of amines, and its ‘hydrolysis’ to corresponding carboxylic acids.** |
|  | **Week 11****5.1.9 and 6.2.8 and 6.2.9** | * Bronsted-Lowry acids and bases (5.1.9). Here definition of what is referred to as acids/alkalis are discussed and the rational provided.
* Reactions of Nitriles. The nucleophilic addition of CN-, and the addition or extension of carbon chain is discussed in detail, via reaction mechanism. Furthermore its reduction to corresponding amines, and hydrolysis to corresponding carboxylic acids, are discussed.
* Reactions of nitriles to produce amines or carboxylic acids are discussed.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5 the various definition of acids is discussed.****In module 6 reactions of nitriles and extended organic synthesis is studied. In all these modular parts, many timed- questions are presented that we follow by going through the answers.** |
|  | **Week 12**5.1.10, and 6.2.10 and 6.2.11 | * Acid-base and Ka. The expression of the equation for Ka and hence the calculation of concentration of hydrogen ion, to establish the pH of a solution is studied by going through worked examples and timed questions.
* Skills in Organic Chemistry. This is mainly gained throughout the course whilst involved with practical assessments. Use of various instruments, glassware, and reaction conditions should be reiterated by the teacher, as well as reflection of all issues relating to safety and the appropriate use of chemical.
* The reaction conditions as well as when to use reflux/or distillation set ups.
* Synthesis
* Culmination of all knowledge acquired from organic synthesis employed to make proposed compounds.
* Aromatic synthesis in Electrophilic substitution as well as all other reactions to produce the desired products through numerous questions (my own), as well as questions from past papers, are discussed.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on.Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5, Ka is studied, to calculate both the concentration and/or the pH of an acidic solution. Basic maths skills in many topics in module 5 is expected.****In module 6 we are now at a stage, where we can challenge students with advance, multi-step reactions and synthesis routes, as well as reaction conditions and reaction mechanisms.** |
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|  | **Week 13** 5.1.11 and 6.3.1 | * Calculating the pH of Strong and Weak acids (5.1.11). Going through worked examples as well as timed questions is essential.
* Chromatography as the essential first step approach in identification oof compounds is discussed. Important to mention no identification can occur if we have a mixture. TLC as well as GC are required to be discussed in detail going through some worked examples. The idea can then be extended to include the idea of GC-MS, or other spectroscopic interfaces.
* Calculation of Rf
* 2-D and even 3-D TLC
* Idea is then extended to Gas Chromatography (GC)
* Reiterating that analysis leading to identification of mixtures, is only possible when they are separated and pure, which is achieve via chromatographic approaches.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5 we now have reached a point where calculation of pH of weak and strong acids can be tackled. The** pH and the H ion **concentration is discussed and practice questions using the equation will be done.****In module 6 we start on the Analytical part of the course, which encompass Chromatographic and Spectroscopic techniques. Here we start with the idea of chromatography as a separation technique,** **that is done by machines, such as TLC and GC.** |
|  | **Week 14****5.1.12, and 6.3.2** | * Ionization of water and Kw (5.1.12)
* Tests for Organic compounds.
* Use of acidified 2,4-DNPH (Brady’s reagent), to identify Aldehydes OR ketones.
* Use of Ammonical AgNO3 (Tolle’s reagent), to identify Aldehydes, where ketones might be present to. The idea to refer to this reaction as a redox reaction and to be able to write the ionic equation to show the nature of reaction.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| In module 5, The idea of ionisation of water and Kw, will enable students to calculate the pH of Alkali solutions. Here there will be ample opportunities to go through various Qs to embed the idea.In module 6 various reagents that can identify compounds such as aldehyde and ketones are studied.  |
|  | **Week 15** **PAG and Mini Test** | PAG and Mini Test 6.2 | Reflection of the test, going through the answers. |
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|  | **Week 16** PAG and 6.3.3 | PAG* NMR (proton) (6.3.3). The theory and how NMR works needs elaboration. Then the identification of organic compounds using NMR spectroscopy, in particular H-NMR is discussed going through many examples to embed the idea, which at first might appear quite challenging to students.
* The theory of how NMR works and the required conditions and conditions, e.g. Rf as well as internal standard TMS, and the use of D2O, discussed.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
| In module 6 part 3 NMR, has always been the most challenging part of the course. At least to begin with. Here the theory as well as how **NMR can lead to identification of organic compounds (on its own), can be achieved. Usually, other spectroscopic techniques such as IR, need further data from say Mass Spectroscopy, to lead to identification. NMR can be used on its own to identify. Numerous Qs will be provided for the students to practice through to embed the idea**. |
|  | **Week 17** 5.1.13 and NMR | * Buffers (5.1.13). Going through the equations of weak acid/weak acid salts and how buffer solutions maintain the same pH value should be discussed in detail. Perhaps the importance of blood as being a buffer can be used to address the importance of the topic.
* Analysis of NMR spectrographs are discussed through numerous questions. The idea of where the signal appears and why do they appear as singlet, doublet or any other multiples, discussed.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5 the idea of how buffer solutions are made and how chemically upon addition of small quantities of H+ or OH-, can maintain the same pH is discussed. Furthermore, the pH of the buffer solutions can be calculated. Again, appropriate number of Qs should be employed.**  |
|  | **Week 18** 5.1.13, and 6.3.3 and 6.3.4 | * Buffer Calculation of pH. Need to show how the pH of a buffer solution can be calculated through worked examples and questions.
* NMR (H+ and C13)
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|  | **Week 19**5.1.14 and 6.3.3 and 6.3.4 | * Titration Curves
* NMR- Analysis
* NMR analysis is continued, and the C13 NMR is employed to discuss the symmetrical or asymmetrical organic molecules, and how in combination of access to both H and C13 spectra, identification of unknowns can be established. C13 NMR is also introduced at this stage, which helps in identification of different isomers with the same H-NMT spectra.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on.Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In module 5 Titration curve of weak acid-weak base, weak acid-strong base, strong acid-weak base and strong acid-strong based are discussed.****In module 6 extended and more challenging questions relating to NMR analysis is practiced.** |
|  | **Week 20**PAG and Combined Techniques | PAGCombined Techniques |  |
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|  | **Week 21** Tests | Mini-test 5.1.7-5.1.14Major test ALL 6.3 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
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|  | **Week 22****Review of 5.1.1-5.1.14 and 5.2.1 and 5.2.2** | * Review 5.1.1-5.1.4
* Lattice enthalpy (5.2.1 and 5.2.2)
* Born-Haber cycle. Need to show how enthalpy of lattice can be calculated using the Born-Haber cycles, by consideration of energies involved in each step.
* Calculations related to lattice enthalpy and all energy requirements relating to formation of one mole of an ionic salt is discussed. Here we use the ‘Born-Haber’ cycle (diagram), to show the various steps involved and the energy whether exo or endothermic), is discussed.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on.Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **Lattice enthalpy is discussed in detail, and we elaborate as to how different stages and hence energy exchanges are involved in preparation of an ‘ionic salt’.**  |
|  | **Week 23** PAG and 5.2.3 and 5.2.4 | PAG* Lattice Enthalpy calculation (5.2.3 and 5.2.4)
* Enthalpy of solution.
* Calculation of lattice enthalpy via the relationship between enthalpy of hydration of ions equalling enthalpy of lattice plus enthalpy of solution is discussed for ionic salts that re SOLUBLE.
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on.Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **The relationship between enthalpies of hydration of ions and lattice enthalpy and enthalpy of solution is discussed. This will be a simpler approach to calculate the enthalpy of lattice of ionic compounds, however as long as they are ‘soluble’.** |
|  | **Week 24** Review and 5.2.5 and 5.2.6 | * Review 5.1.5-5.1.9
* Entropy and Free energy. Entropy is introduced as the degree of disorder in chemical reactions. The importance of this topic is that it enables us to exactly calculate at ‘what temperature’ a reaction become feasible.
* The equation
* Feasibility of reactions
* The lowest temperature at which reactions become feasible
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
| **At this stage the students are familiar with the concept of enthalpy, however the relationship between ‘entropy’ and ‘Gibbs free energy’, (G), is a new concept that are interrelated in the equation.**  |
|  | **Week 25****Review and 5.2.7 and 5.28** | * Review 5.1.10-5.1.14
* Redox and Redox calculations
 | Past papers, or tests.Tests are marked by teacher and answers are reflected on. |
| This area can be approached in a smart way by discussing how what is known as corrosion (at GCSE level), and then Redox (in year 12), can now be approached ain a numerical way. I.e. we will be able to quantify redox and give it a numerical value, to let students know how rapid or slowly such redox reactions take place. | * Electrochemical cell. Some might consider this topic quite challenging. The best approach is to open up this topic, which enable students to give redox reactions a numerical value. The value of voltage is of utmost importance, very low n indication of a slow redox reaction with species involved having similar chemical behaviour, and high voltages, that might reflect fast moving reactions, even explosive ones.
* How to calculate Voltage of a cell
* How to construct the cell and the role of hydrogen electrode is essential.
* Electron direction which half-cell undergoes oxidation is also the one that releases the electrons Often questions are asked about the direction of electrons, which should be shown on the wire, connecting the two half cells.
* How the Electron voltage and its signs will enable us to construct the redox equation
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|  | **Week 26** PAG Completion, and 5.2.9 and 5.2.10 | * PAG- completion and standardisation
* Electrode potential as an overall voltage of the cell (battery) is easily calculated. (The more +ve minus the less +ve).
* Cell potential
* Introduction of electro potential calculation as a mean to quantify corrosion, or redox. Using this approach enable students to appreciate the significance of the topic.
* Furthermore, paying particular attention to the value of voltage and whether it is negative or positive is discussed.
* Construction of electrochemical cells as well as that of hydrogen half-cell is discussed.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
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|  | **Week 27****5.3.1 and 5.3.2** | * Transition Metals. Here the electronic configuration is employed again and for the first time the d-orbitals are discussed, and how in Complex ions the 5 d-orbitals degenerate into 2 upper DZ2 and dx2-Y2, and the 3 lower, dxy, dxz and dyz orbitals.
* The idea of ’vacancies’ in the upper 2 and promotion of electrons from the lower 3 to the upper 2, using a certain part of the ‘visible light’, is discussed, which leads to the understanding as to why complex ions of transition metals are ‘colourful’.
* Transition compounds
* The idea of the criteria required for an element to be considered a ‘transition mental (element), is discussed.
* Particular attention is given to electronic configuration and the role of d-orbitals.
* Furthermore, the idea of why transition metal complex ions are colourful is discussed in how the degenerated d-orbitals absorb certain part of the visible light, whilst the rest (as colours) are seen.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
| **In A-level we study the 1sr raw Transition elements (metals). We need to define what they are and why Sc and Zn do not qualify as Transition metals.**  |
|  | **Week 28****5.3.5 and 5.3.6** | * Ligand substitution. This idea can be related to how oxygen and carbon dioxide can exchange, but Oxygen and carbon monoxide cannot in the lungs, to enhance understanding.
* Demonstration of ligands and how exchanges can occur and why colour of complex ions changes as ligand exchanges take place (due to lower 3 upper 2 d-orbital energy gap differences, discussed.
* Furthermore the idea of isomerism and even stereoisomerism in complex ions are discussed.
 | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
|  **Ligand exchange and the colour change are discussed and demonstrated.**  |
|  | **Week 29** Completion and submission of PAGs and5.3.7 and 5.3.8 | * PAGs Completion and ready to enter
* Redox
* Testing for ions
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|  | **Week 30**5.3.3 and 5.3.4 | * Complex ions
* Stereoisomerism**.** The shapes and the rational as to why some are square planar, whilst others tetrahedral is discussed. The octahedral shapes and the Cis, Trans isomerism in ‘monodentate’ ligands is discussed. The idea of ‘optical isomerism’ is discussed when ‘bidentate ligands, such as ethane diamine, is used.
* PAGS to enter on OCR before 15th May
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| **Stereo isomerism in complex ions is discussed.**  |
|  | **Week 31**Review ALL |  | Dr Salem’s own written questions from a bank of 600+ Questions and answers are used to provide further help in implementation of objectives relating to topics |
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|  | **Student Leave** |  |  |