Changes in the syllabus content

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| **Topic 1: Stoichiometric relationships Time: 13.5 hours (previously 12.5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Introduction to elements, compounds, mixtures, chemical equations, states of matter, changes of state | Standard temperature and pressure | New material was previously implicit  (and so does not represent an increase in teaching/learning) |
| Explanation of real gas behaviour | Ideal gas equation (now given in the data booklet) | Allows for NOS connection and deeper understanding of relation to particle theory |
| Homogeneous and heterogeneous phases |  | Broadens scope for practical work and work in topics 7 and 17—equilibrium |
| Specific experimental work on deriving empirical formulas |  | Prescribed practical |
| Standard solution and titration |  | Prescribed practical |

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| **Topic 2: Atomic structure Time: 6 hours (previously 4 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
|  | Operation of the mass spectrometer | The previous content was out-dated and over-simplified. Modern applications added to topic 11 and option A |
|  | Uses of named radioisotopes | Recall-based learning |
| Electron configuration for atoms up to *Z*= 36 |  | Moved from AHL so that all students use the same model |
|  | Electron arrangement up to *Z* = 20 | No longer necessary as electron configuration added |
|  | Knowledge of series in different parts of the spectrum | Recall-based learning reduced; now in the data booklet |

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| **Topic 3: Periodicity Time: 6 hours (previously 6 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Electron configuration from position in periodic table; use of group numbers from 1 to 18 | Electron arrangement up to *Z* = 20 | Alignment with changes in topic 2 |
| Knowledge of group trends limited to alkali metals and halogens | Similarities and differences in the chemical properties of elements in the same group | Reduces the amount of recall required |

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| **Topic 4: Chemical bonding and structure Time: 13.5 hours (previously 12.5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Resonance structures in organic chemistry |  | Allows for links to topic 10 |
| Graphene |  | An important network covalent compound that was not well known when previous guide was produced |
| Use of the terms *anion* and *cation* |  | These are used in topic 9 and topic 19 |
|  | No significant deletions as the topic contains key chemical ideas that are applied elsewhere in the course | Concepts remain the same but some of the rote memorization has been deleted |

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| **Topic 5: Energetics/thermochemistry Time: 9 hours (previously 8 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Standard enthalpy changes of reaction |  | Moved from AHL |
| Bond energy calculations for ozone required as a specific example |  | Provides a relevant link to environmental chemistry |
|  | No significant deletions as the topic contains key chemical ideas that are applied elsewhere in the course | Concepts remain the same but some of the rote memorization has been deleted |

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| **Topic 6: Chemical kinetics Time: 7 hours (previously 5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Potential energy profiles with and without catalysts; understanding of activation energy is specified |  | Implied in previous syllabus but never explicitly stated |
| Prescribed practical to investigate rates | Description of experiments to measure rates | Although students are expected to understand and apply changes in mass, volume or colour to monitor rate, there is less emphasis on recall |
|  | No significant deletions as the topic contains key chemical ideas that are applied elsewhere in the course | Concepts remain the same but some of the rote memorization has been deleted |

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| **Topic 7: Equilibrium Time: 4.5 hours (previously 5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Reaction quotient, *Q* |  | Enriches the current content by describing how a system changes as it moves towards equilibrium |
|  | Details of applications to industrial processes | Concepts could still be applied to these examples but students are not expected to recall factual details |

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| **Topic 8: Acids and bases Time: 6.5 hours (previously 6 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Acid deposition |  | Environmental application |
| pH calculations for strong and weak acids |  | Creates a link to maths and allows quantitative chemistry for SL in this topic |
| Use of the pH meter and Universal Indicator paper |  | Prescribed practical |
|  | Lewis theory | Moved to AHL topic 18 |

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| **Topic 9: Redox processes Time: 8 hours (previously 7 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Redox titration problems |  | Provides opportunity for a deeper understanding in applications and skills. The mathematical concepts are the same as in topic 1 but in a different application |
| Application of the activity series to deduce the feasibility of a reaction |  | This is not an addition in principle, but a means of reducing recall, or avoiding the use of the electrochemical series at this level |
| Biological oxygen demand (BOD) and the Winkler method |  | Environmental application |
|  | No significant deletions as the topic contains key chemical ideas that are applied elsewhere in the course | Concepts remain the same but some of the rote memorization has been deleted |

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| **Topic 10: Organic chemistry Time: 11 hours (previously 12 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Naming of esters |  | Completes the naming of basic organic structures |
| Identification of general formulae |  | Implicit in the old guide—now formally required |
| Identification of nitrile and akynyl functional groups |  | Identification of functional groups no longer divided between core and AHL topics |
| Structure and bonding in benzene |  | A more complete overview of organic chemistry, plus a link to topic 4 |
|  | SN1 and SN2 mechanisms | Moved to AHL |
|  | Reaction pathways | Most synthetic pathways moved to AHL |

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| **Topic 11: Measurement and analysis Time: 10 hours (previously 2 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Descriptions of quantitative and qualitative data |  | Previously implicit in lab work |
| Calculation of percentage error |  | Previously implicit in lab work |
| Distinction between sketched and drawn graphs |  | Added to clarify a distinction sometimes not apparent to students |
| Analytical techniques |  | Moved from previous topics (10 and 20) and from option A to create a coherent sub-topic; operating principles are not required |
| Index of hydrogen deficiency |  | Useful as part of the process of structure elucidation |

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| **Topic 12: Atomic structure Time: 2 hours (previously 3 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
|  | Electron configurations | Moved to topic 2 |
| Use of the convergence limit to calculate the ionization energy |  | Allows a quantitative approach to this topic |

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| **Topic 13: The periodic table—the transition metals Time: 4 hours (previously 4 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| More understanding of transition metals required, for example, magnetic properties |  | Greater importance of transition metals in modern chemistry |
| Coloured complexes added as a sub-topic |  | Greater detail than in the current guide with more emphasis on understanding |
|  | Trends in chlorides and oxides of the third period | Reduces the amount of recall required |
|  | Specific examples of catalytic action and industrial processes | Reduces the amount of recall required |

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| **Topic 14: Chemical bonding and structure Time: 7 hours (previously 5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| The concept of formal charge |  | This is a more modern approach that allows identification of preferred Lewis structure |
| Mechanism and catalysis of ozone depletion |  | Environmental application |
|  | Specific examples of catalytic action and industrial processes | Reduces the amount of recall required |

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| **Topic 15: Energetics/thermochemistry Time: 7 hours (previously 8 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
|  | Standard enthalpy of reaction | Moved to SL |
| Enthalpy of hydration |  | Enables students to carry out lab work on energy cycles. Provides better coherence with Hess’s law in the core syllabus |
|  | Theoretical lattice enthalpies and polarizing effects | The approach was too simplistic |
| Relation of Δ*G* to position of equilibrium |  | Enhances understanding and links to topic 17 |

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| **Topic 16: Chemical kinetics Time: 6 hours (previously 6 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| A more thorough understanding of the use of the Arrhenius equation is specified |  | Gives greater clarity to the syllabus |

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| **Topic 17: Equilibrium Time: 4 hours (previously 4 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Δ*G* = –*RT*ln*K* |  | Application/connection with topic 15; note that solving quadratic equations for equilibrium expressions remains beyond the scope of this syllabus |
|  | Liquid–vapour equilibrium | Reduces the amount of recall required |

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| **Topic 18: Acids and bases Time: 10 hours (previously 10 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Lewis Theory of acids and bases |  | Moved from topic 8 (core) |
|  | Buffer calculation | Moved to biochemistry option |
|  | Acidity of transition metal salts | Reduces the amount of recall required; explanation of equivalence points on titration curves is still expected |

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| **Topic 19: Redox processes Time: 6 hours (previously 5 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| EMF (cell potential) definition |  | Provides greater understanding of the essential idea |
| Δ*G* = –nFE |  | Connection to topics 15 and 17 |
|  | No significant deletions as the topic contains key chemical ideas that are applied elsewhere in the course | Concepts remain the same but some of the rote memorization has been deleted |

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| **Topic 20: Organic chemistry Time: 12 hours (previously 10 hours)** | | |
| **Addition** | **Deletion** | **Rationale** |
| SN1 and SN2 mechanisms |  | Moved from core: more applicable to AHL |
| Electrophilic substitution—nitration |  | Links to inclusion of Benzene in topic 10; provides more opportunities for applications and synthetic routes |
| Reduction reactions—carbonyls |  | Provides more opportunities for applications and synthetic routes |
| Stereoisomerism in more detail, including E/Z nomenclature and diasteromers |  | Updating of idea to align with the International Union of Pure and Applied Chemistry (IUPAC) and allow identification of isomerism in a broader range of compounds |
| Synthetic pathways introduced as a sub topic ; paths with up to four steps are specified, as well as the concept of retro-synthesis |  | Previously only two steps were assessed which provided limited scope for application; retro synthesis gives an alternative problem-solving approach |
|  | Elimination | A less useful reaction; removed to reduce the amount of recall |
|  | Condensation | Naming of esters moved to topic 10 Condensation polymerization now in options A and B |

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| **Topic 21: Measurement and analysis Time: 2 hours (new topic)** | | |
| **Addition** | **Deletion** | **Rationale** |
| Nuclear magnetic resonance (NMR)—specifically interpretation of multiplets and use of TMS |  | Moved from analytical chemistry option |
| Awareness of X-ray crystallography |  | Prevents focus on a single technique in the process of structure elucidation |

Options

The four option topics are new and so a comparison with previous option topics is not feasible. Each topic contains elements of quantitative chemistry, analytical techniques, environmental issues and organic chemistry, and there is new content in all of them to ensure the topics are up to date. Teachers are encouraged to look at each of the topics and decide which ones will best match the needs and interests of their classes.

Changes to external assessment

There are some changes to the examination papers. These are summarized below.

* The weighting of the assessment objectives for paper 1 has changed so that 50% of the paper will address objective 3.
* Assessment of the NOS may be incorporated into any of the questions in the three examination papers.
* In paper 2 there will no longer be any choice of question. Students will answer all questions in section A (short answer) and all questions in section B (extended response).
* On paper 3 there will be two sections: in section A students will answer data-based questions and in section B they will choose one of the options.