Subject	Y12 Core Knowledge – Autumn/Spring/Summer term	How to support students' learning
Science - Chemistry	**Autumn Term** **Atomic structure -** 1. Interpret simple mass spectra of elements. 2. Calculate relative atomic mass from isotopic abundance, limited to mononuclear ions. 3. Define first ionisation energy. 4. Write equations for first and successive ionisation energies. 5. Explain how first and successive ionisation energies in Period 3 (Na–Ar) and in Group 2 (Be–Ba) give evidence for electron configuration in sub-shells and in shells. 6. Define relative atomic mass (Ar). 7. Define relative molecular mass (Mr). 8. Use equations for moles and concentration accurately. 9. Calculate empirical formula from data giving composition by mass or percentage by mass. 10. Calculate molecular formula from the empirical formula and relative molecular mass. 11. Write balanced equations for reactions studied. 12. Balance equations for unfamiliar reactions when reactants and products are specified. **Bonding -** 13. Predict the charge on a simple ion using the position of the element in the Periodic Table. 14. Construct formulas for ionic compounds. 15. Represent a covalent bond using a line. 16. Represent a co-ordinate bond using an arrow. 17. Relate the melting point and conductivity of materials to the type of structure and the bonding present. 18. Explain the energy changes associated with changes of state. 19. Draw diagrams to represent these structures involving specified numbers of particles. 20. Explain the shapes of, and bond angles in, simple molecules and ions with up to six electron pairs (including lone pairs of electrons) surrounding the central atom. 21. Use knowledge of electronegativity and partial charges to show that a bond is polar. 22. Explain why some molecules with polar bonds do not have a permanent dipole. 23. Explain the existence of intermolecular forces between familiar and unfamiliar molecules.	• CGP AQA A level Chemistry year 1 revision guide (can be bought through the school). • CGP AQA A level Chemistry year 1 textbook (can be bought through the school). • Seneca: https://senecalearning.com/en-GB/ Free revision resource. **Chem guide:** • https://www.chemguide.co.uk/ • MaChemguy: https://www.youtube.com/channel/UCyl4QJXN9zNapzmKAn-fJgQ **Free science lessons:** • https://www.freesciencelessons.co.uk/a-level-revision-videos/a-level-chemistry/ • Physics and maths tutor https://www.physicsandmathstutor.com/chemistry-revision/a-level-aqa/ MaChemguy video tutorials and exam question walk throughs: • https://sites.google.com/view/machemguyocra/home

	24. Explain how melting and boiling points are influenced by intermolecular forces. 25. Draw structural, displayed and skeletal formulas for given organic compounds. **Intro to organic chemistry -** 26. Apply IUPAC rules for nomenclature to name organic compounds limited to chains and rings with up to six carbon atoms each. 27. Apply IUPAC rules for nomenclature to draw the structure of an organic compound from the IUPAC name limited to chains and rings with up to six carbon atoms each. 28. Define the term structural isomer. 29. Draw the structures of chain, position and functional group isomers. 30. Define the term stereoisomer. 31. Draw the structural formulas of E and Z isomers. 32. Apply the CIP priority rules to E and Z isomers. **Alkanes and halogenoalkanes -** 33. Explain the economic reasons for cracking alkanes and know the conditions and products of each type. 34. Explain why sulphur dioxide can be removed from flue gases using calcium oxide or calcium carbonate. 35. Write balanced equations for the steps in a free-radical mechanism. 36. Explain the free-radical substitution mechanism involving initiation, propagation and termination steps. 37. Outline the steps of a nucleophilic substitution mechanism. 38. Explain why the carbon–halogen bond enthalpy influences the rate of reaction. 39. Explain the role of the reactive species as both nucleophile and base. **Spring** **Energetics -** 40. Define standard enthalpy of combustion (ΔHcΘ) 41. Define standard enthalpy of formation (ΔHfΘ). 42. Use the calorimetry equation to calculate the molar enthalpy change for a reaction. 43. Use Hess's law to perform calculations, including calculation of enthalpy changes for reactions from enthalpies of combustion or from enthalpies of formation. 44. Define the term mean bond enthalpy.	

	45. Use mean bond enthalpies to calculate an approximate value of ΔH for reactions in the gaseous phase. 46. Explain why values from mean bond enthalpy calculations differ from those determined using Hess's law. **Kinetics -** 47. Define the term activation energy. 48. Explain why most collisions do not lead to a reaction. 49. Draw and interpret distribution curves for different temperatures. 50. Use the Maxwell–Boltzmann distribution to explain why a small temperature increase can lead to a large increase in rate. 51. Explain how a change in concentration or a change in pressure influences the rate of a reaction. 52. Use a Maxwell–Boltzmann distribution to help explain how a catalyst increases the rate of a reaction involving a gas. **Alkenes and alcohols -** 53. Outline the mechanisms for alkene addition reactions. 54. Explain the formation of major and minor products by reference to the relative stabilities of primary, secondary and tertiary carbocation intermediates. 55. Draw the repeating unit of an addition polymer from a monomer structure. 56. Draw the repeating unit from a section of the polymer chain. 57. Draw the structure of the alkene monomer from a section of the addition polymer. 58. Explain why addition polymers are unreactive. 59. Explain the nature of intermolecular forces between molecules of polyalkenes. 60. Explain the meaning of the term biofuel. 61. Justify the conditions used in the production of ethanol by fermentation of glucose. 62. Write equations to support the statement that ethanol produced by fermentation is a carbon neutral fuel and give reasons why this statement is not valid. 63. Outline the mechanism for the formation of an alcohol by the reaction of an alkene with steam in the presence of an acid catalyst.	

	64. Discuss the environmental (including ethical) issues linked to decision making about biofuel use. 65. Write equations for oxidation reactions of alcohols and aldehydes (use equations showing [O] as the oxidant). 66. Explain how the method used to oxidise a primary alcohol determines whether an aldehyde or carboxylic acid is obtained. 67. Use chemical tests to distinguish between aldehydes and ketones including Fehling's solution and Tollens' reagent. 68. Outline the mechanism for the elimination of water from alcohols. **Organic analysis -** 69. Identify the functional groups in a molecule using observations and information from reactions in the specification. 70. Use precise atomic masses and the precise molecular mass to determine the molecular formula of a compound. 71. Use infrared spectra and the Chemistry Data Booklet to identify particular bonds, and therefore functional groups, and also to identify impurities. **Summer Term** **Equilibria and redox reactions -** 72. Use Le Chatelier's principle to predict qualitatively the effect of changes in temperature, pressure and concentration on the position of equilibrium. 73. Explain why, for a reversible reaction used in an industrial process, a compromise temperature and pressure may be used. 74. Construct an expression for Kc for a homogeneous system in equilibrium. 75. Calculate a value for Kc from the equilibrium concentrations for a homogeneous system at constant temperature. 76. Perform calculations involving Kc. 77. Predict the qualitative effects of changes of temperature on the value of Kc. 78. Work out the oxidation state of an element in a compound or ion from the formula. 79. Write half-equations identifying the oxidation and reduction processes in redox reactions. 80. half-equations to give an overall redox equation.	

	Group 2 and group 7 - 81. Explain why acidified silver nitrate solution is used to identify halide ions. 82. the trends in atomic radius and first ionisation energy in group 2. 83. Explain the melting point of the group 2 elements in terms of their structure and bonding. 84. Explain why $BaCl_2$ solution is used to test for sulfate ions and why it is acidified. 85. Explain the trend in electronegativity in group 7. 86. Explain the trend in the boiling point of the group 7 elements in terms of their structure and bonding. 87. Explain how acidified silver nitrate solution followed by dilute and concentrated ammonia solutions are used to identify halide ions, including simplest ionic equations. 88. Explain how different reagents are used to identify positive and negative ions in an unknown solution. 89. Explain with equations the reducing power of the halide ions. 90. Explain with equations the oxidising power of the halogens.	