Subject	Y12 Core Knowledge – Autumn/Spring/Summer term	How to support students' learning
Science - Biology	**Autumn Term** **Biological molecules -** 1. Explain what a monomer and polymer are. 2. Identify some biological polymers and the monomer from which they are made. 3. Explain the concept of condensation and hydrolysis reactions in forming/breaking down polymers. 4. Identify common monosaccharides and describe the monosaccharides from which lactose, maltose and sucrose are made. 5. Explain what is meant by a glycosidic bond and how they form through condensation. 6. Describe how polymerisation of α-glucose can form starch or glycogen. 7. Describe the tests for starch, a reducing and non-reducing sugar in detail. 8. Explain what is meant by qualitative testing. 9. Represent the structure of α -glucose and β – glucose diagrammatically. 10. Explain that glycosidic bonds between α– glucose form starch or glycogen and how this relates to their function and properties. 11. Explain that glycosidic bonds between β– glucose form cellulose and how this relates to its function and properties. 12. Describe the stages of the emulsion test and interpret the results. 13. Describe the structure of triglycerides and explain how they form. 14. Recognise, from diagrams, saturated and unsaturated fatty acids. 15. Describe the structure of phospholipids. 16. Explain the properties of phospholipids related to their structure. 17. Contrast the different properties of triglycerides and phospholipids. 18. Describe the general structure of an amino acid. 19. Describe the biuret test and how it can be interpreted. 20. Explain the variety of functions that proteins have and why they are so important to the body. 21. Explain the principle of chromatography. 22. Identify amino acids in a mixture by interpreting chromatograms. 23. Explain how dipeptides and polypeptides form.	• CGP AQA A level Biology year 1 revision guide (can be bought through the school). • CGP AQA A level Biology year 1 textbook (can be bought through the school). **Seneca:** • https://senecalearning.com/en-GB/ Free revision resource. • Free science lessons: https://www.freesciencelessons.co.uk/a-level-revision-videos/a-level-chemistry/ • Physics and maths tutor: https://www.physicsandmathstutor.com/biology-revision/a-level-aqa/

	24. Explain the hierarchical organisation of protein structure. 25. Describe the types of bonds involved in protein structure and the weakness of hydrogen bonds. 26. Relate the structure of proteins to properties of proteins. 27. Interpret energy level diagrams and identify the activation energy. 28. Explain the induced-fit model of enzyme action. 29. Apply knowledge of tertiary structure to explain enzyme specificity and the formation of enzyme-substrate complexes. 30. Explain how temperature, pH, substrate concentration, enzyme concentration and the presence of inhibitors affect enzyme catalysis. 31. Describe and explain trends within graphs, relating this back to the tertiary structure of active sites and the effect of variables (pH, substate concentration, enzyme concentration and inhibitor presence). 32. rate of reaction from graphs and raw data and explain the advantage of using initial rate. 33. Interpret graphs of enzyme-controlled reactions and apply knowledge to explain them. 34. Explain the features of good experimental design. 35. Process data to calculate rates. 36. Represent raw and processed data clearly using tables and graphs. 37. Apply knowledge to draw and explain conclusions. 38. Evaluate results and conclusions. 39. Explain the significance of DNA to organisms. 40. Describe the structure of DNA and identify structural components from diagrams. 41. Apply knowledge of complementary base pairing rules to work out the frequency of certain bases, when provided with information about the frequency of the other bases. 42. Explain why many scientists initially doubted that DNA was the genetic code. 43. Explain the role of RNA in transferring genetic information and as a component of the ribosome. 44. Describe the structure of RNA and identify structural components of an RNA nucleotide from diagrams. 45. Compare and contrast the similarities and differences between DNA and RNA.	

	Cells - 46. Identify the features of eukaryotic cells. 47. Apply their knowledge of these features in explaining adaptations of eukaryotic cells. 48. Identify features of prokaryotic cells. 49. Identify features of viruses. 50. Explain how viruses replicate. 51. Recognise the stages of the cell cycle: interphase, prophase, metaphase, anaphase and telophase (including cytokinesis). 52. Explain the appearance of cells in each stage of mitosis. 53. Explain the adaptations of specialised cells in relation to the rate of transport across their internal and external membranes. 54. Explain how surface area, number of channel or carrier proteins and differences in gradients of concentration or water potential affect the rate of movement across cell membranes. **Spring Term** **Cells -** 55. Explain response of B lymphocytes to a foreign antigen, clonal selection and the release of monoclonal antibodies (the humoral response). 56. Describe the use of vaccines to provide protection for individuals and populations against disease. The concept of herd immunity. 57. Explain differences between active and passive immunity. 58. Discuss ethical issues associated with the use of vaccines and monoclonal antibodies. 59. Evaluate methodology, evidence and data relating to the use of vaccines and monoclonal antibodies. 60. Relate the base sequence of nucleic acids to the amino acid sequence of polypeptides, when provided with suitable data about the genetic code. 61. Interpret data from experimental work investigating the role of nucleic acids. **Biological molecules -** 62. Describe the process of DNA replication and explain its significance. 63. Evaluate the work of scientists in validating the Watson-Crick model of DNA replication and apply your knowledge to explain experimental results from the work of these scientists. 64. Describe the structure of ATP.	

	65. Explain the role of enzymes in hydrolysing and synthesising ATP. 66. Explain the significance of ATP in numerous processes within organisms, as a supplier of energy or phosphate. 67. Describe the properties that are important in water. 68. Explain the properties of water linked to the polar nature of the molecule. 69. Explain the significance of these properties to living organisms and processes. 70. Explain what is meant by the term inorganic ions and where they occur in the body. 71. Explain the specific role of hydrogen ions, iron ions, sodium ions and phosphate ions and relate the role of each of these ions to their properties. **Organisms exchange substances with their environment -** 72. Explain how the size of an organism affects its surface area to volume ratio and why this is important. 73. Apply your knowledge of surface area to volume ratio, to explain adaptations to body shape or the development of exchange systems. 74. Describe and explain the relationship between surface area to volume ratio and metabolic rate. 75. Calculate surface area to volume ratios when supplied with cell/organism dimensions. 76. Describe the internal structure of a leaf and explain how the structure is an adaptation allowing efficient gas exchange. 77. Explain what a xerophytic plant is and the adaptations that they have and how these balance the needs for gas exchange whilst minimising water loss. 78. Explain the adaptations of single-celled organisms for efficient gas exchange. 79. Describe the structure of insect tracheal systems and explain how it is adapted to allow efficient gas exchange. 80. Explain how tracheal systems balance the need for gas exchange whilst minimising water loss. 81. Describe the structure of fish gills and explain how they are adapted to maximise gas exchange, including counter current flow. 82. Describe the structure of the human gas exchange system and explain the roles of cartilage in the trachea and bronchi.	

	83. Explain the role of ventilation in terms of maintaining diffusion gradients. 84. Explain the mechanism of breathing in terms of the action of the diaphragm muscle and the antagonistic action of the external and internal intercostal muscles and the pressure changes which they cause in the thoracic cavity. 85. Explain the process of gas exchange, related to blood circulation and ventilation. 86. Describe the features of the squamous epithelium and explain how it is adapted to maximising gas exchange. 87. Interpret information relating to the effects of lung disease on gas exchange and/or ventilation. 88. Interpret data relating to the effects of pollution and smoking on the incidence of lung disease. 89. Analyse and interpret data associated with specific risk factors and the incidence of lung disease. 90. Recognise correlations and causal relationships. 91. Explain the general roles of organs within the digestive system and where key events in digestion happen. **Summer Term** **Genetic information, variation and relationships between organisms -** 92. Complete diagrams showing the chromosome content of cells after the first and second meiotic division, when given the chromosome content of the parent cell. 93. Explain the different outcome of mitosis and meiosis. 94. Recognise where meiosis occurs when given information about an unfamiliar life cycle. 95. Explain how random fertilisation of haploid gametes further increases genetic variation within a species. 96. Use unfamiliar information to explain how selection produces changes within a population of a species. 97. Interpret data relating to the effect of selection in producing change within populations. 98. Show understanding that adaptation and selection are major factors in evolution and contribute to the diversity of living organisms. 99. Appreciate that advances in immunology and genome sequencing help to clarify evolutionary relationships between organisms.	

	100. Interpret data relating to similarities and differences in the base sequences of DNA and in the amino acid sequences of proteins to. 101. Suggest relationships between different organisms within a species and between species. **Organisms exchange substances with their environment -** 102. Explain the purpose of digestion and the role of different enzymes in the digestive process and relate the specificity of enzymes back to protein structure. 103. Explain how endopeptidases and exopeptidases increase protein digestion. 104. Explain the role of bile salts. 105. Explain the features of good experimental design. 106. Identify hazards and evaluate associated risk when designing experiments. 107. Research and adapt methodology as the basis for designing an experiment. 108. Process data to calculate rates. 109. Represent raw and processed data clearly using tables and graphs. 110. Apply knowledge to draw and explain conclusions. 111. Evaluate the quality of results and reliability of conclusions. 112. Recall the adaptations of intestinal epithelial cells to exchange. 113. Explain the absorption of amino acids and glucose against a concentration gradient by co-transport. 114. Explain the role of micelles in the absorption of lipids. 115. Describe the structure of the circulatory system, with particular reference to the blood vessels entering/leaving the heart, lungs and kidneys. 116. Link the structure of the circulatory system to its role in exchanging and transporting materials. 117. Relate knowledge of protein structure to the structure of haemoglobin. 118. Explain what is meant by the term “partial pressure”. 119. Explain how the binding of one oxygen molecule changes the shape of haemoglobin and how this affects the binding of further oxygen molecules.	

	120. Relate knowledge to explain the shape of an oxyhaemoglobin dissociation curve. 121. Explain the effect of carbon dioxide concentration on oxygen dissociation and relate this knowledge to explain oxygen loading and unloading in different tissues. 122. Explain differences between the oxyhaemoglobin dissociation curves of different species and relate these differences to the environment in which the organisms live to explain how these adaptations allow organisms to survive. 123. Describe and label the structure of the heart. 124. Explain differences in the thickness of cardiac muscle between the atria and ventricles and between different sides of the heart. 125. Explain the role of the atrio-ventricular and semilunar valves. 126. Explain the role of the coronary artery. 127. Explain the cardiac cycle. 128. Explain the opening and closing of AV and semi-lunar valves in terms of differences in pressure at different stages of the cardiac cycle. 129. Analyse and interpret data relating to pressure and volume changes during the cardiac cycle. 130. Describe the structure of arteries, arterioles, veins and capillaries, and relate their structure to their functions. 131. Compare and contrast the structure and function of different blood vessels. 132. Explain what tissue fluid is and which substances it contains. 133. Explain the formation of tissue fluid in terms of hydrostatic pressure and explain the reabsorption of some tissue fluid back into the capillaries, in terms of hydrostatic pressure and water potential. 134. Explain the role of the lymph system. 135. Apply knowledge of circulation to draw and explain conclusions. 136. Analyse and interpret data associated with specific risk factors and the incidence of cardiovascular disease. 137. Recognise correlations and causal relationships. 138. Explain the role of the xylem in plants. 139. Explain how water transport in the xylem is linked to transpiration in the leaves.	

	140. Explain the cohesion-tension theory of water transport. 141. Explain the factors which affect transpiration. 142. Explain the role of the phloem in plants. 143. Explain what is meant by translocation. 144. Explain the mass flow hypothesis as a mechanism for translocation. 145. Interpret evidence from tracer and ringing experiments and evaluate the evidence for and against the mass flow hypothesis.	