Meden School Curriculum Planning							
Subject	Biology	**Year Group**	13	**Sequence No.**		**Topic**	3.5 Energy Transfer in and Between Organisms 1

Retrieval	Core Knowledge	Student Thinking
What do teachers need **retrieve** from students before they start teaching **new content**?	What **specific ambitious knowledge** do teachers need teach students in this sequence of learning?	What real life examples can be applied to this sequence of learning to **development of our students thinking, encouraging them to see the inequalities around them** and 'do something about them!'
AQA GCSE Biology B4 Bioenergetics, photosynthesis, the rate of photosynthesis, respiration and metabolism, aerobic and anaerobic respiration AQA GCSE Biology B7 Ecology trophic levels, pyramids of biomass, biomass transfer. A level Biology 3.1.6 ATP	**3.5.1 Photosynthesis** The light-dependent reaction in such detail as to show that: • chlorophyll absorbs light, leading to photoionisation of chlorophyll • some of the energy from electrons released during photoionisation is conserved in the production of ATP and reduced NADP • the production of ATP involves electron transfer associated with the transfer of electrons down the electron transfer chain and passage of protons across chloroplast membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory) • photolysis of water produces protons, electrons and oxygen. The light-independent reaction uses reduced NADP from the light- dependent reaction to form a simple sugar. The hydrolysis of ATP, also from the light-dependent reaction, provides	How can the knowledge of photosynthesis be used to help solve the food crisis in some parts of the world? What is regenerative farming? How can hydroponics be used to grow food in areas of poor soil quality. Can artificial light sources (using renewable energy) play an important role in food production

A level Biology 3.2.1 Cell Structure and organelle function	the additional energy for this reaction. The light-independent reaction in such detail as to show that: • carbon dioxide reacts with ribulose bisphosphate (RuBP) to form two molecules of glycerate 3-phosphate (GP). This reaction is catalysed by the enzyme rubisco • ATP and reduced NADP from the light-dependent reaction are used to reduce GP to triose phosphate • some of the triose phosphate is used to regenerate RuBP in the Calvin cycle • some of the triose phosphate is converted to useful organic substances. • identify environmental factors that limit the rate of photosynthesis • evaluate data relating to common agricultural practices used to overcome the effect of these limiting factors. **Required practical 7:** Use of chromatography to investigate the pigments isolated from leaves of different plants, eg, leaves from shade-tolerant and shade-intolerant plants or leaves of different colours. **Required practical 8:** Investigation into the effect of a named factor on the rate of dehydrogenase activity in extracts of chloroplasts. **3.5.2 Respiration** Respiration produces ATP Glycolysis is the first stage of anaerobic and aerobic respiration. It occurs in the cytoplasm and is an anaerobic process. Glycolysis involves the following stages: • phosphorylation of glucose to glucose phosphate, using ATP	where avaiable land is in short supply Horticultural lighting for sustainable food production | Signify Company Website

	• production of triose phosphate • oxidation of triose phosphate to pyruvate with a net gain of ATP and reduced NAD. If respiration is aerobic, pyruvate from glycolysis enters the mitochondrial matrix by active transport Aerobic respiration in such detail as to show that: • pyruvate is oxidised to acetate, producing reduced NAD in the process • acetate combines with coenzyme A in the link reaction to produce acetylcoenzyme • acetylcoenzyme A reacts with a four-carbon molecule, releasing coenzyme A and producing a six-carbon molecule that enters the Krebs cycle • in a series of oxidation-reduction reactions, the Krebs cycle generates reduced coenzymes and ATP by substrate-level phosphorylation, and carbon dioxide is lost • synthesis of ATP by oxidative phosphorylation is associated with the transfer of electrons down the electron transfer chain and passage of protons across inner mitochondrial membranes and is catalysed by ATP synthase embedded in these membranes (chemiosomotic theory) • other respiratory substrates include the breakdown products of lipids and amino acids, which enter the Krebs cycle. **Required practical 9:** Investigation into the effect of a named variable on the rate of respiration of cultures of single-celled organisms. **3.5.3 Energy and Ecosystems** In any ecosystem, plants synthesise organic compounds from atmospheric, or aquatic, carbon dioxide. Most of the sugars synthesised by plants are used by the plant as respiratory substrates. The rest are used to make other groups of biological molecules. These biological molecules form the biomass of the plants.	

	Biomass can be measured in terms of mass of carbon or dry mass of tissue per given area. The chemical energy store in dry biomass can be estimated using calorimetry. Gross primary production (*GPP*) is the chemical energy store in plant biomass, in a given area or volume. Net primary production (*NPP*) is the chemical energy store in plant biomass after respiratory losses to the environment have been taken into account, ie $NPP = GPP - R$ where *GPP* represents gross production and *R* represents respiratory losses to the environment. This net primary production is available for plant growth and reproduction. It is also available to other trophic levels in the ecosystem, such as herbivores and decomposers. The net production of consumers (*N*), such as animals, can be calculated as: $N = I - (F + R)$ where *I* represents the chemical energy store in ingested food, *F* represents the chemical energy lost to the environment in faeces and urine and *R* represents the respiratory losses to the environment. Primary and secondary productivity is the rate of primary or secondary production, respectively. It is measured as biomass in a given area in a given time eg kJ ha–1 year–1. Appreciate the ways in which production is affected by farming practices designed to increase the efficiency of energy transfer by: simplifying food webs to reduce energy losses to non-human food chains reducing respiratory losses within a human food chain. **3.5.4 Nutrient Cycles** Nutrients are recycled within natural ecosystems, exemplified by the nitrogen cycle and the phosphorus cycle. Microorganisms play a vital role in recycling chemical elements such as phosphorus and nitrogen.	Are biofuels viable alternative to fossil fuels? Are they really carbon-neutral? Should land be used to grow food or biofuels? Is veganism better for the environment and the climate? What is the science behind the current trend in veganism? How can farmers balance the need for fertilisers and their negative effects on the environment and surrounding ecosystems.

	The role of saprobionts in decomposition. The role of mycorrhizae in facilitating the uptake of water and inorganic ions by plants. The role of bacteria in the nitrogen cycle in sufficient detail to illustrate the processes of saprobiotic nutrition, ammonification, nitrification, nitrogen fixation and denitrification. (The names of individual species of bacteria are **not** required). The use of natural and artificial fertilisers to replace the nitrates and phosphates lost by harvesting plants and removing livestock. The environmental issues arising from the use of fertilisers including leaching and eutrophication.	