Extended Response (Core Concepts and Component 1): Eduqas A Level Biology Exam Questions

16 questions · 144 marks · about 173 minutes. Answer in the spaces, then check the mark schemes at the end.

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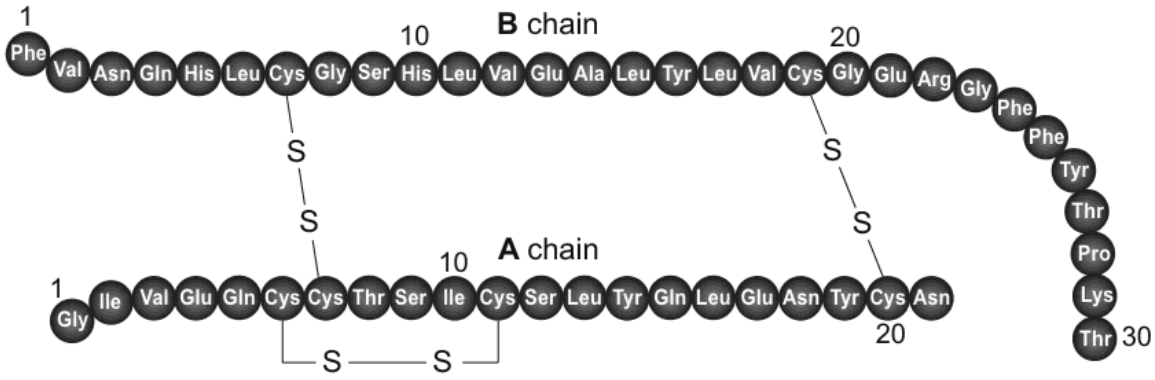
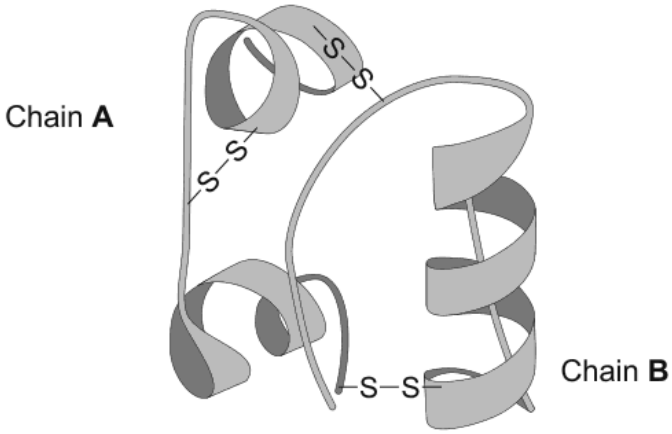
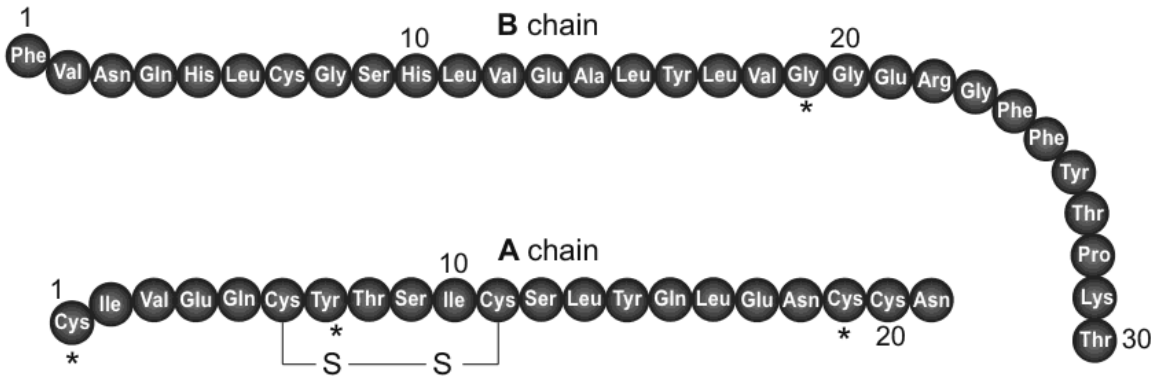
6. Insulin is a protein composed of polypeptide chains **A** and **B** and is involved in the control of blood glucose levels. It binds to receptors in the cell membranes of cells causing them to absorb more glucose from the plasma.

The diagrams below show the amino sequence of a fully functional insulin molecule and a ribbon drawing to show its three dimensional structure.





Some types of diabetes result from changes to the structure of the insulin molecule caused by mutations. The amino acid sequences of mutated **A** and **B** chains are shown below. Mutations are marked with an asterisk (*).



Explain how these changes could affect **each level of protein structure** of insulin. Suggest how this may make the hormone non-functional.
You should use all the information provided and your own knowledge of protein structure and function in your answer. [9 QER]

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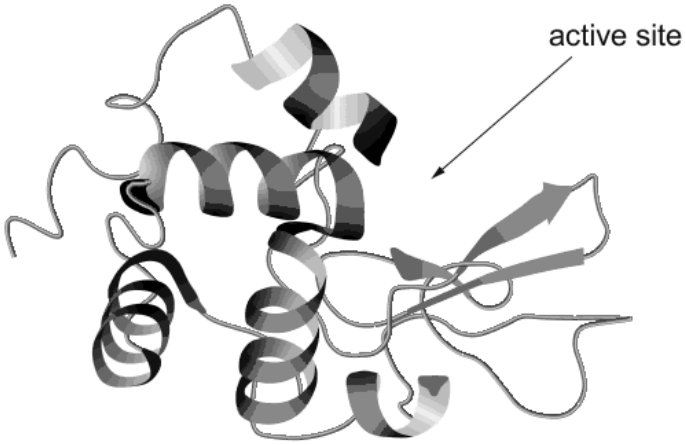
6. Lysozyme is an enzyme which catalyses the breakdown of glycosidic bonds in polysaccharides in bacterial cell walls. It works using the induced fit model of enzyme action. **Image 6.1** shows a computer-generated model of lysozyme.

Image 6.1



Describe the three levels of protein structure present in the lysozyme molecule shown in **Image 6.1**.
Explain how the three levels of protein structure are maintained.
Describe and explain the induced fit model of enzyme action as shown by lysozyme. [9 QER]

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8. **Images 8.1** and **8.2** show the structure of mitochondria and chloroplasts.

Image 8.1

Mitochondria

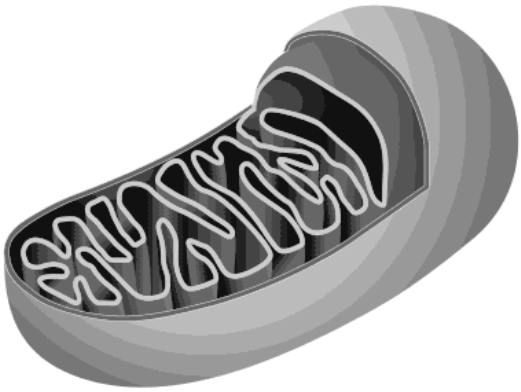
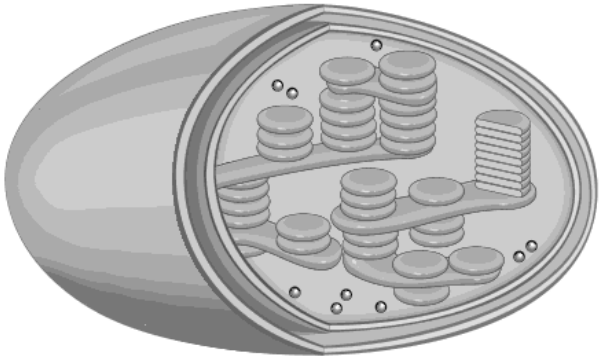


Image 8.2

Chloroplast



Explain how the internal structures of mitochondria and chloroplasts are adapted to carry out respiration and photosynthesis respectively. Using your knowledge and evidence from the images, describe the evidence that suggests that both mitochondria and chloroplasts have evolved from bacteria. [9 QER]

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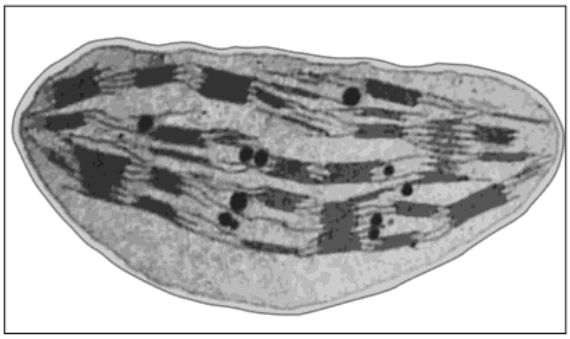
7. A symbiotic relationship is the interaction between two different species living in close physical association to the advantage of both.

In 1967, Lynn Margulis proposed the theory of endosymbiosis and suggested that mitochondria and chloroplasts evolved from free-living prokaryotes that were taken into other prokaryotic cells by endocytosis to form the first eukaryotic cells.

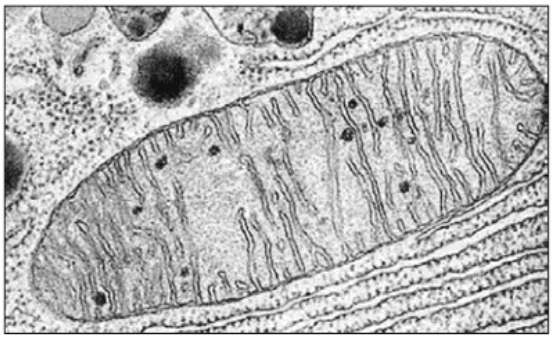
The electron micrographs below show the detailed structure of a chloroplast and a mitochondrion.

Chloroplast



1 µm

Mitochondrion



0.5 µm

Compare the structures of mitochondria and chloroplasts to prokaryotes.

Describe and explain how the double membrane observed in both organelles was formed, and how this supports the theory of endosymbiosis.

Suggest the advantages of this symbiotic relationship to the mitochondria, the chloroplasts and the newly formed eukaryotic cell. [9 QER]

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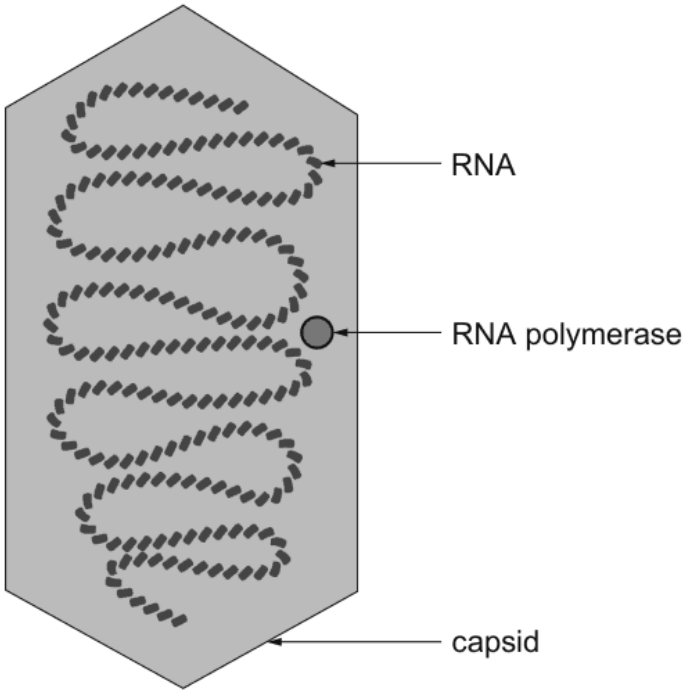
6. Viruses cause infections in many mammals including humans. The basic structure of a virus is shown in **image 6.1**.

Image 6.1



The virus must enter a host cell in order to reproduce. Once inside, the viral RNA is replicated using viral RNA polymerase enzyme. Viral RNA then acts as a code to synthesise the capsid protein using the host cell's organelles.

Compare the structure of the virus shown in **image 6.1** with the structure of a human cell. Describe and explain how the viral RNA is replicated and then used to make viral protein molecules. [9 QER]

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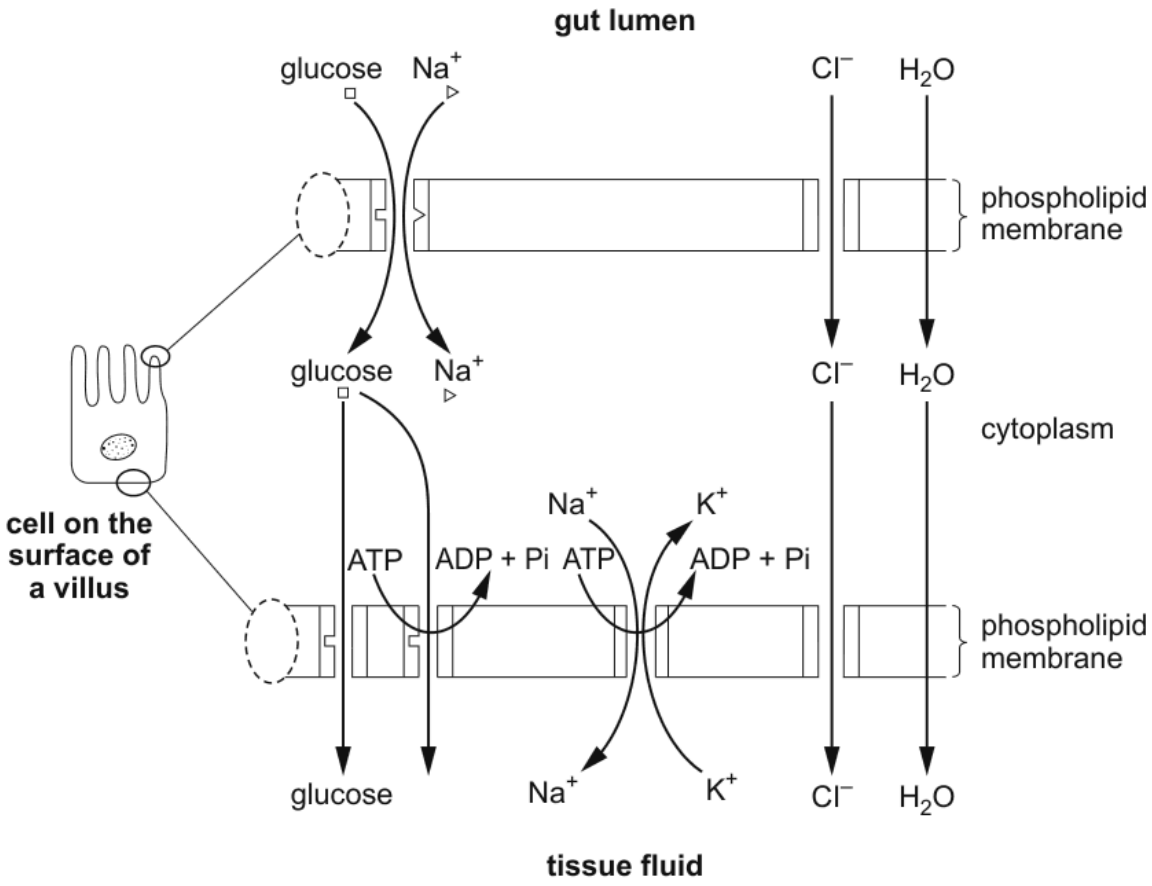
6. **Image 6** shows how cells covering the surface of a villus in the small intestine transport some molecules from the gut lumen into tissue fluid.

Image 6



Identify the main transport methods shown in **Image 6** and state which molecules are transported by each method.

Describe the key features of each of these transport methods.

Explain how the efficiency of glucose transport into tissue fluid is increased by using a combination of transport methods. [9 QER]

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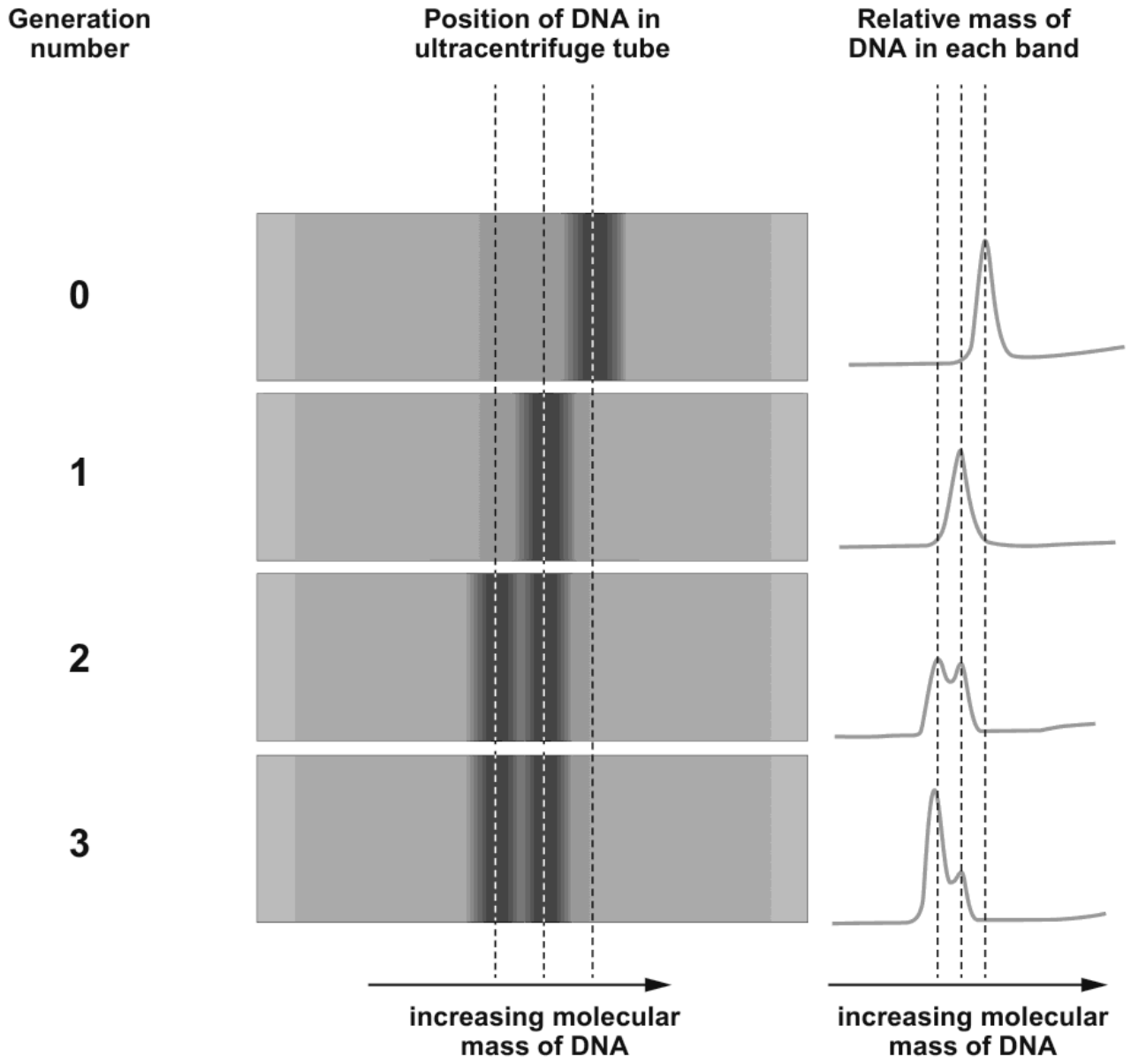
Question 7 · AS Component 1 · June 2018 · Q6 · 9 marks

6. In 1958, Matthew Meselson and Franklin Stahl conducted a series of experiments that demonstrated that DNA replication is semi-conservative.

The images below show some of their results.



Other theories of DNA replication included:

- conservative replication, in which the original DNA is retained as a double stranded molecule; and
- dispersive replication, where the original DNA is split into many fragments which are then dispersed throughout the replicated molecules.

Using your own knowledge of Meselson and Stahl's experiments, explain how their experiment and the results shown in the image supported the theory of semi-conservative replication. Predict how the results would have differed if the other theories had been correct. Explain your answer. [9 QER]

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6. Cells of the airway in humans secrete mucus. The thickness of this mucus is regulated by the movement of chloride ions through an intrinsic membrane protein called CFTR. This protein is coded for by the CFTR gene.

Cystic fibrosis is a condition where the movement of chloride ions is reduced, resulting in thicker mucus. The condition can be caused by mutations in the CFTR gene. One mutation causes the deletion of a single amino acid from the protein.

Use your knowledge of the genetic code and protein synthesis to explain how a mutation in the CFTR gene could cause a deletion of an amino acid.

Describe how this deletion could affect the structure of the CFTR protein.

Suggest how this deletion could affect the function of the CFTR protein. [9 QER]

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Question 9 · A level Component 1 · June 2017 · Q9 · 9 marks

9. Biochemical reactions in cells often involve cyclic metabolic pathways which occur within compartments inside cells.
Compare the Krebs cycle and Calvin cycle in plant cells with reference to their biochemistry and explain why the cellular compartmentalisation in both cycles is so important. [9 QER]

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Question 10 · A level Component 1 · June 2018 · Q7 · 9 marks

7. More than a billion years ago, aerobic bacteria colonised primordial eukaryotic cells that lacked the ability to use oxygen metabolically. A symbiotic relationship developed and became permanent. The bacteria evolved into mitochondria, thus enabling the host cells to carry out aerobic metabolism, a much more efficient way to release energy than anaerobic glycolysis.

Describe the role of mitochondria in eukaryotic cells using your knowledge of respiratory pathways.
Explain how the original aerobic bacteria and primordial eukaryotic cells benefitted from this relationship.
Detailed diagrams are not required. [9 QER]

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6. In 2004, it was estimated that approximately 18% of the human population lacked access to safe drinking water.
In most industrialised nations, samples of drinking water are cultured in laboratories. Any bacteria present are identified using microscopic methods. The samples are monitored for the presence and level of different types of faecal bacteria, some of which can be pathogenic. Bacterial load (the number of bacteria per cm^3) is determined using a viable count.

State the conditions needed to culture bacteria in a laboratory and explain why each of these conditions is required.
Describe how different types of bacteria can be identified using microscopic methods.
Explain what is meant by a viable count and describe how you could determine the bacterial load of a sample of drinking water. (Details of aseptic technique are not required.) [9 QER]

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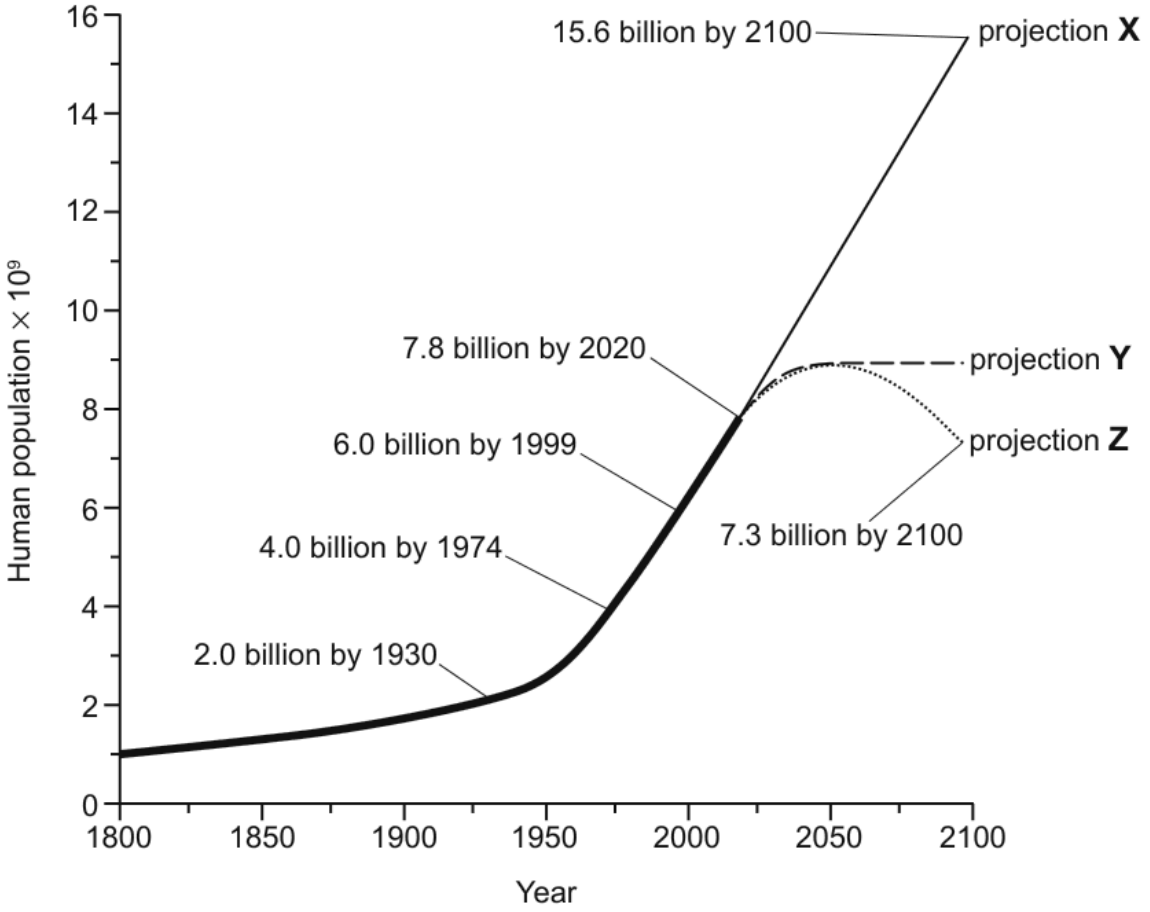
7. **Graph 7** shows how the human population has changed since 1800. It also shows three projections of how the world population might change by the end of the 21st century.

Graph 7



At present, population scientists believe that projection **X** is the most likely world population by 2100.

State what is meant by density-dependent and density-independent factors and explain how these factors might account for the change in the human population growth curve between 1800 and 2020.
Use the population growth curves shown in **Graph 7** to explain what projections **X**, **Y** and **Z** represent in terms of human population size.
Suggest how the climate change planetary boundary might be affected if projection **Z** becomes reality. [9 QER]

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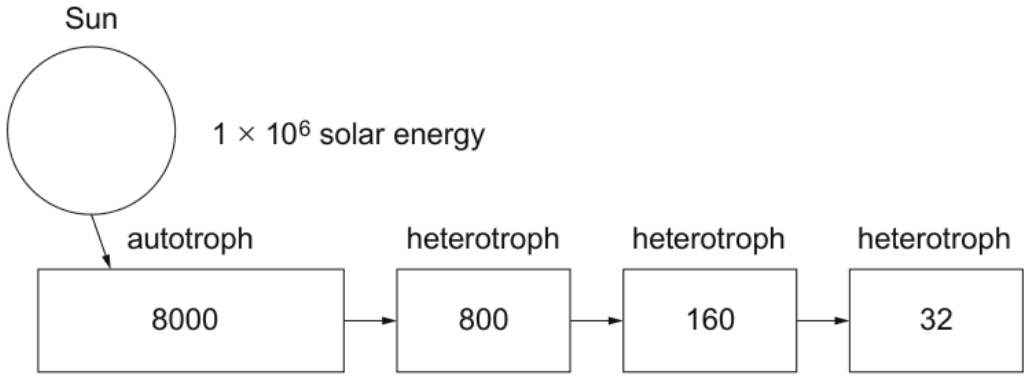
7. The diagram below shows the flow of energy through an ecosystem.



Figures represent $kJ\,m^{-2}\,yr^{-1}$

Using the diagram, explain what is meant by the flow of energy through an ecosystem and why energy is lost at each stage.

Explain why the efficiency of transfer might change at each stage.

Suggest ways by which farmers can improve the efficiency of the transfer between each level.

[9 QER]

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7. Succession is the change in structure and species composition of a community over time. Primary succession from bare rock to a mature community can take hundreds of years. Secondary succession, for example, following the felling of trees, takes far less time.

Forests are habitats that can support a high level of biodiversity. In some countries, forests are given nature conservation status and are unmanaged. There is limited harvesting of wood and no clearance of dead wood or undergrowth. This helps to preserve habitats.

In managed forests, secondary succession is encouraged by the regular felling of trees. The removal of dead and decaying wood and undergrowth in these forests reduces the spread of disease.

Evidence suggests that by using sustainable forest management practices, the demand for timber and the need for conservation can be met.

Table 7 compares data from an unmanaged nature conservation forest and a managed timber production forest. Both forests contained similar tree species.

Table 7

	Type of forest	
	unmanaged nature conservation forest	sustainably managed timber production forest
increase in volume of wood / m^3 hectare^{-1} year^{-1}	2	15
maximum volume of wood / m^3 hectare^{-1}	624	757
time for trees to reach felling height / years	175	50
useful wood harvest / million m^3 year^{-1}	10–15	56–86
carbon storage / tonnes CO_2 hectare^{-1} year^{-1}	0.4	3.2–3.5
increase in species biodiversity over time / %	0	0.005

Use correct terminology to describe the stages in primary succession that could result in the initial formation of a forest from bare rock.
Explain why biodiversity increases as the forest community matures.
With reference to the information opposite, explain how managed forest succession can meet the need for timber production and be of benefit to the environment. [9 QER]

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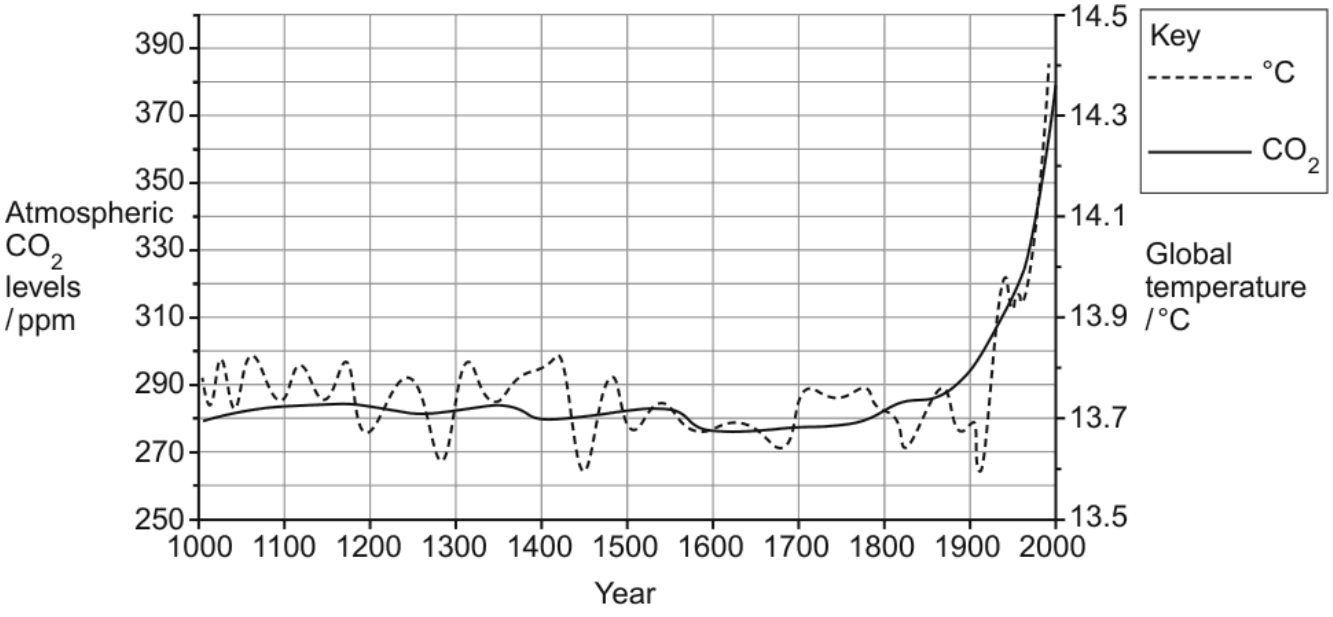
7. Since the beginning of the Industrial Revolution (250 years ago), carbon dioxide concentration in the atmosphere has risen from about 280 parts per million to 408 parts per million in 2018. This means that for every million molecules in the atmosphere, 408 of them are now carbon dioxide, the highest concentration in two million years. Ice samples provide a record of the Earth's atmospheric temperature and CO_2 levels. The data below shows how global temperatures and atmospheric CO_2 levels have changed from the year 1000.



Use your knowledge of the carbon cycle to explain how humans have affected global carbon dioxide levels and temperature levels. Use the information and data provided to support your answer.
Describe the effects of increasing carbon dioxide levels and global temperatures on aquatic environments. [9 QER]

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Question 16 · A level Component 1 · June 2022 · Q7 · 9 marks

7. It has been estimated that 10 million km^2 of forest have been lost from the planet since the beginning of the 20th century. One of the reasons for deforestation is to meet the demands for food for an increasing human population.

Explain how the conversion of forests to areas of intensive human food production using modern agricultural practices often leads to the death of fish and aquatic invertebrates. Describe the harmful impacts of deforestation on the environment and suggest how the conflicts of interest between food production and conservation can be resolved. [9 QER]

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Mark schemes

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Question 1 · AS Component 1 · June 2017 · Q6 · 9 marks

6	**Indicative content** **Primary, secondary, tertiary, quaternary structure** • primary – sequence of amino acids held by peptide bonds • secondary – coiling/ folding of polypeptide chain held by hydrogen bonds • tertiary – further folding of secondary structures due to R group interactions/ ionic/ covalent/ S-S/ hydrogen bonds/ hydrophobic interactions • quaternary – more than one polypeptide chain held together **Effect of changes on levels of protein structure** • primary protein structure changed due to amino acid sequences of both A and B chains are different • secondary structure could change how the α helices in A and B chains would form • tertiary structure would change as different amino acids would change R/ variable groups bonding between different parts of polypeptide chains e,g, Changing aa 1 and 19 of chain A could result in additional / different disulphide bridges forming • Quaternary structure Changing Cys to Gly (aa B chain 19) and Cys to Tyr (aa A chain 7) mean that disulphide bridges may not form between the A and B chains. **Effect on Functionality** • Insulin must be able to bind to receptors so must have a specific shape • Any change to 3D shape of the insulin molecule could affect how it binds to receptor molecules • {prevent/ reduce abiity of} cells to absorb glucose from the plasma.	5	4	9
	7-9 marks Indicative content of this level is: Detailed explanation of levels of protein structure **and** Detailed explanation of effects of change on protein structure **and** Detailed explanation of the effect of functionality *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is: **Any two from:** Explanation of levels of protein structure Explanation of effects of change on protein structure Explanation of the effect of functionality *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some*			

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6	**Section A – levels of protein structure** (definitions/description) primary structure • the sequence/order of amino acids in a polypeptide secondary structure • folding of the primary structure • alpha-helix and beta-pleated sheets formed tertiary structure • further folding/ folding of secondary structure • forms a globular protein/ specific 3D shape **Section B – how levels are maintained** (bonding) primary structure • peptide bonds between amino acids secondary structure • hydrogen bonds between –OH/polar R groups tertiary structure • hydrogen bonds between –OH/polar R groups • ionic bonds between charged R groups • disulphide bonds between sulphur-containing R groups • hydrophobic interactions/ hydrophobic R groups in centre (away from water), hydrophilic R groups on outside of protein **Section C – enzyme action** (induced fit) • active site is complementary to only one substrate • substrate binds to the enzyme's active site • active site changes shape slightly to fit more closely around substrate • this puts strain on the bonds in substrate • less energy needed to break bond/ lowers activation energy • products not complementary to active site so leave/are released
	7-9 marks Indicative content of this level is… Detailed description of three levels of protein structure Detailed description of bonding Detailed description of enzyme action To award 9 marks a description of the bonds maintaining each level must be included *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant*

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8

Mitochondria (A)

structure	adaptation
Inner mitochondrial membrane	Contains etc for ATP synthesis
cristae	Folded inner membrane to increase surface area
Intermembrane space	Enables Proton gradient to be established
matrix	Producing carriers
Ribosomes	Produce {enzymes/ dehydrogenase/ decarboxylase}

Chloroplast (B)

structure	adaptation
Thylakoid membrane	Contain photosystems/ photosynthetic pigments for harvesting light/ electron transfer chain – production of ATP
grana	large area of thylakoid membranes/ large number of thylakoid
Thylakoid space	Enables proton gradient to be established
Stroma	Contains enzymes for Calvin cycle/ owtte
Ribosomes	Produce enzymes/ rubisco

6 3 0 9 0 0

Endosymbiont theory (C)

- Cristae similar to mesosomes in bacteria
- Thylakoid membranes similar to photosynthetic membranes in bacteria.
- Circular DNA
- No histones associated with DNA
- DNA not enclosed by nuclear membrane.
- Small ribosomes. 70s (80s in eukaryotes)
- Capable of division.
- Double membrane

7-9 marks
Indicative content of this level is detailed coverage of all three areas
The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks
Indicative content of this level is detailed coverage of two areas or less detailed coverage of all three areas.
The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks

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Question 4 · AS Component 1 · June 2019 · Q7 · 9 marks

7				Comparison to prokaryotes - Presence of circular DNA used for self-replication - Presence of 70S ribosomes used for production of proteins - Double membrane (cf prokaryotes) - Comparable size (1 – 10 μm) - Chloroplasts share presence of chlorophyll similar to photosynthetic bacteria - Bacteria have mesosomes which may be involved in cellular respiration similar to cristae Endocytosis - Infoldings / extensions of plasma membrane to form vesicle - Organelles engulfed / membrane surrounds organelles - Double membrane produced / Bacterial cell membrane surrounds organelle membrane - Vesicle formed and moves through cell, taking in organelles - Organelles eventually a permanent feature of cell Endosymbiotic advantages - Initially provided a temporary benefit, eventually became an evolutionary advantage. - Compartmentalisation - Protection of mitochondria and chloroplasts - Raw materials supplied to the organelles - Internalised nutrient supply for bacteria via photosynthesis - Internalised energy source		5	4	9
				7-9 marks Indicative content of this level is… Detailed account of all three areas *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Detail from any two areas or less detailed account from three areas *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.*				
				1-3 marks Indicative content of this level is… Content from any one area *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer*				

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6	• Human cell's genetic material is DNA, virus has only RNA • Human cell has a cell membrane, virus has capsid • Human cell has nucleus with nuclear envelope, virus does not have a nucleus • Human cell has mitochondria, ribosomes, Golgi, rough/smooth E.R. (named organelle), virus has no organelles • Human cell has chromosomes, virus does not • RNA released from virus capsid inside host cell • RNA polymerase enzyme 'reads' base sequence on virus RNA • Free RNA nucleotides pair up with nucleotides on virus RNA • Complementary base pairing / C pairs with G, U pairs with A • RNA polymerase catalyses formation of RNA molecule • (Replicated) virus RNA attaches to ribosome • tRNAs match anti-codon to codons on virus RNA/ complementary base pairing • tRNAs bring amino acids to ribosome • amino acids joined by peptide bonds to form polypeptide • role of other cell organelles	5 4 0 9
	7-9 marks Indicative content of this level is… Detailed comparison of the structure of virus and host cell Detailed explanation of virus RNA replication Detailed explanation translation of virus RNA *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Any two from: Description of the structure of virus and host cell Explanation of virus RNA replication Explanation of translation of virus RNA *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.*	
	1-3 marks Indicative content of this level is… Brief description of the structure of virus and host cell	

Question 6 · AS Component 1 · June 2025 · Q6 · 9 marks

	Types of transport: A1 osmosis + facilitated diffusion + active transport (+ co-transport) A2 water (+ osmosis) A3 glucose / Na^+ / Cl^- (+ facilitated diffusion) A4 glucose / Na^+ / K^+ (+ active transport) A5 glucose + Na^+ + cotransport **Key Features:** **Osmosis**: B1 (water) moves from high water potential to lower water potential / {passive / no ATP / relies on kinetic energy} **Facilitated diffusion / co-transport**: B2 particles move from high concentration to lower concentration / {passive / no ATP / relies on kinetic energy} B3 requires a channel protein / transports {charged / polar / ionic} particles **Active transport:** B4 particles can move from low concentration to higher concentration / {active / requires ATP /} B5 requires a carrier protein / transports {charged / polar / ionic} particles **Efficiency of glucose transport:** C1 glucose absorbed into {cytoplasm / cell} C2 absorption into cell does not rely on glucose concentration gradient / glucose transported with Na+ C3 (so) higher concentration of glucose in {cytoplasm / cell} than tissue fluid / greater concentration gradient between {cytoplasm / cell} and tissue fluid C4 active transport out of cell {increases concentration gradient of {Na+ / glucose} between {cytoplasm / cell} and gut lumen} / results in more {Na+ / glucose} entering {cytoplasm / cell} C5 active transport ensures continued absorption of glucose if low concentration in the {cytoplasm / cell} (than tissue fluid) / maintains concentration gradients owtte	**3 4**	**2**	**9**	**0 0**
	7-9 marks Indicative content of this level is… detailed description of all three areas of indicative content *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately*. **4-6 marks** Indicative content of this level is… description of at least two areas of indicative content *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately* **1-3 marks** Indicative content of this level is… description of at least one area of indicative content *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.*				

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6.	**Indicative content** • description of experiment including details of use of heavy and light isotopes of N and use of ultracentrifugation • explanation of how bands seen in centrifuge tube are formed giving details of heavy and light strands for each generation in terms of the heavy and light isotopes of N • the relative amounts of DNA in each band are explained conservative replication: • always some heavy DNA present • increasing mass of light DNA • no intermediate DNA • because original heavy DNA is not split Dispersive replication: • apart from G_0, all DNA would be intermediate in molecular mass • getting lighter between Go and G3 • because original heavy DNA split between all new molecules	2 2 5 9
	7-9 marks • detailed description of experimental procedure and explanation of results • correct detailed explanation to reject conservative theory • correct detailed explanation to reject dispersive theory *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** • description of experimental procedure and explanation of results • correct explanation to reject conservative theory • correct explanation to reject dispersive theory OR • detailed description of experimental procedure and explanation of results • correct detailed explanation to reject either conservative theory or dispersive theory *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content,*	

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Question 8 · AS Component 1 · June 2024 · Q6 · 9 marks

6	**Genetic code and protein synthesis** A1 Gene codes for a polypeptide A2 Triplet code = one amino acid A3 No mRNA code for missing amino acid / deletion of 3 bases or triplet / codes for stop codon instead A4 No codon-anticodon complex for that particular aa A5 Amino acid missing from the primary sequence / polypeptide chain **Structure of the CFTR protein** B1 Different primary structure / different amino acid sequence / shorter B2 Different secondary structure e.g. different hydrogen bonds B3 Different tertiary structure B4 Bonds form in different places / R groups B5 3D shape changed **Function of protein** C1 Transport protein is not correct shape / complementary C2 Cl^- doesn't fit through / is not transported C3 So mucus viscosity not regulated / owtte C4 May no longer span the membrane as an intrinsic protein C5 Hydrophobic and hydrophilic regions may now not be in correct position	2 6	1 9		
	7-9 marks Indicative content of this level is detailed content from all three areas *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed content of any two areas. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any correct statement from the indicative content *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*				

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Question 9 · A level Component 1 · June 2017 · Q9 · 9 marks

9 Indicative content

Calvin cycle	**Krebs cycle**
in chloroplasts	in mitochondria
in photosynthesis	in respiration
forms the three C sugar TP/eq	mitochondria break down a 2 C compound/acetyl group
fixes/eq carbon dioxide	produces carbon dioxide
reduces GP to TP using reduced NAD**P**	produces reduced NAD
uses ATP	produces (a small quantity of) ATP directly.
uses the enzyme Rubisco	uses dehydrogenase and decarboxylase enzymes

Compartmentalisation

- Reference to reactions occurring in small volume/isolation of enzymes/reactants.
- Keeping products separate from cytoplasm by use of membranes to isolate reactions within organelles.
- Can use mitochondria close to areas needing ATP/movement of organelles within cytoplasm.

4	5	0	0

7-9 marks

Detailed explanation of Calvin cycle
and
Detailed explanation of Krebs cycle
and
Detailed explanation of compartmentalisation and comparison

The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks
Any two from
Explanation of Calvin cycle
Explanation of Krebs cycle
Explanation of compartmentalisation

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks

Brief explanation of Calvin cycle
or
Brief explanation of Krebs cycle
or
Brief explanation of compartmentalisation

The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer

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Question 10 · A level Component 1 · June 2018 · Q7 · 9 marks

7				*Link reaction and Krebs cycle* • Pyruvate transported in from cytoplasm • Correct description of link reaction • Decarboxylation and dehydrogenation to produce 2C Acetyl coenzyme A • Correct description of Krebs cycle • Correct description of 4C + Acetyl coenzyme A giving 6C molecule. • Progressive removal of C as CO_2 to reform 4C molecule • Removal of H/use of dehydrogenase/ use of decarboxylase • Formation of Reduced NAD and Reduced FAD *Electron transport chain* • Correct description of ETC • use of oxygen as final electron acceptor • Use of Reduced NAD and Reduced FAD as source of high energy electrons for ETC • Formation of an EC gradients/ chemiosmosis • subsequent synthesis of ATP by the use of ATP synthase in stalked particles *Benefits* • *Bacteria* have a source of pyruvate/oxygen • Constant environment e.g. pH/ water potential • Protection from predation • *Eukaryote* – increased ATP availability – increased metabolic rate/increased cell division/increased active transport/able to metabolise other respiratory substrates/e.g. fatty acids • Compartmentalisation • Increase in size/ complexity	7	2	
				7-9 marks Detailed content from Link reaction and Krebs **+** Electron Transport chain **+** Benefits *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Content from any two parts out of Link reaction and Krebs Electron Transport chain Benefits *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Content from one part out of Link reaction and Krebs Or Electron Transport chain Or Benefits			

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6	**Indicative content** **Conditions for bacterial growth in a lab** A1 Water + {transport / metabolic reactions / hydrolysis} A2 {Carbon source / named organic molecule} + {synthesis of organic compounds / respiration} A3 {Nitrogen source / named molecule} + synthesis of {proteins / amino acids / nucleic acids} A4 Suitable / optimum {temperature / pH} Ignore value A5 Reference to {mineral / vitamin / growth factors} requirements A6 Correct ref to oxygen requirements **Identifying bacteria microscopically** B1 Size B2 Shape B3 Description of shapes: two examples from: coccus, bacillus, spirillum, vibrio B4 Staining characteristics / Gram staining B5 Description of results with Gram stain – Gram + purple, Gram -ve red/pink (details of cell wall structure revealed by Gram stain not relevant) **Viable count and serial dilution** C1 Method of determining the number of living cells (in a sample of drinking water) C2 Known volume of organisms is diluted / ref to serial dilution / Example of dilution e.g. in ten-fold steps C3 Known volume added to agar plates, C4 (Incubated and) the colonies counted C5 Justify choice of plate e.g. enough colonies to be confident in the estimate / or description of C6 Assume that one cell gives rise to one colony.	9	9	9
	7-9 marks Indicative content of this level is detailed content from all three areas. *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed content from two areas. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any correct statement from the indicative content. *The candidate makes some relevant points, such as those in the*			

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Question 12 · A level Component 1 · June 2023 · Q7 · 9 marks

7	**Indicative content** **Density dependent and independent factors** A1 Density dependent: increased effect as population increases/ (affect and) are affected by the size of the population A2 Density independent: the effect is the same whatever the population size /(affect but) not affected by the size of the population Examples: A3 {better/ more} food A4 lower levels of disease/ parasites A5 better shelter / housing A6 improved health care / sanitation/ better water supply **Graph explained** B1 X – population still in log phase/ exponential growth/ population doubling in unit time B2 birth (rate) greater than death (rate) / people {living/ surviving} longer B3 Y – reached {stationary (phase) / carrying capacity/ plateaus/ no further change} B4 birth /survival = death rate B5 Z – {decline/ death} phase B6 birth rate less than death rate/ people not living as long **Effect on climate change boundary** C1 decreased population C2 reduces need for fossil fuel combustion so less CO_2 emitted C3 {less deforestation/ more afforestation/ or description of} {so more CO_2 absorbed / can act as carbon sinks} C4 fewer {animals farmed / paddy fields} so less methane C5 get closer to safe operating level for climate change boundary/ effects of crossing the boundary are reduced	2	4	3	9	
	7-9 marks To gain 9 marks: Identifies and explains all THREE of with no irrelevancies or errors *The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** To gain 6 marks: Identifies and explains TWO of *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** To gain 3 marks: Identifies and explains ONE of *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate*					

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Question 13 · A level Component 1 · Autumn 2020 · Q7 · 9 marks

7	**A. Energy flow and loss at each trophic level,** • Energy from the sun converted into energy in organic molecules by plants/ GPP • Plant breaks down sugars by respiration/ NPP • Energy in form of organic molecules is then passed from one trophic level to the next through the food chain when organisms are eaten. • Energy lost by plants e.g. energy lost by radiation/ reflection (not all wavelengths absorbed/ heat of evaporation. • Energy lost by animals e.g. Respiration/ Excretion/ Egestion; Energy which is left in form of organic molecules are stored or used for growth and available for the next trophic level. **B. Efficiency of transfer:** • Cellulose and lignin not easy to digest. • Large loss by egestion. • Protein and fats easy to digest, very little energy lost by egestion. • Higher energy lost by excretion ref urea. Egestion bone feathers. • High respiratory rate energy for movement. • Use of data	4 5 0 9
	C. Improvement. • Grow varieties of autotrophs with higher GPP. • Breed animals with higher efficiency; • Animal feeds with less cellulose; • high energy supplements; • Reduce respiration by e.g. Reducing movement/ Warm buildings • Disease free; **7-9 marks** Indicative content of this level is detailed account of all three areas *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.*	
	4-6 marks Indicative content of this level is detailed account of two areas or less detailed account of three areas.	

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7	**Indicative content:** **Primary succession** A1 **colonisation** (of bare rock) (by lichens and mosses) A2 **pioneer** species (of plants – annuals) A3 (followed by) **perennials/ grasses** A4 (and then) **shrubs** A5 finally {trees / forest} to form the **climax community** A6 each stage referred to as a **sere** / ref to **seral stages** **Increase in biodiversity** B1 increasing total number of {organisms / plants / animals} B2 more {species (of plants) / species richness} B3 improved food source (for animals) / increased NPP / wider food webs / owtte B4 increased number of {ecological niches / habitats / places to live} B5 decay (of dead organisms) increases {soil fertility / ref to soil formation} B6 less variation in abiotic factors e.g. soil moisture content / shade **Managed forest succession** <u>Timber production:</u> C1 trees grow faster / more wood grows each year / wood volume increase C2 less time to reach {felling/ suitable / owtte} height C3 increased (useful) harvest <u>Environment</u> C4 less trees die as less disease C5 {increased carbon storage / less decay so less CO_2 released} benefits climate change C6 (slight) increase in species biodiversity	5	4	9
	7-9 marks Indicative content of this level is detailed statements from all three areas of the indicative content. *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed statements from two areas of the indicative content. *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any correct statement from the			

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7

Carbon cycle – section A

1. People burning fossil fuels
2. Trees store carbon in wood, stems, and leaves—biomass.
3. Deforestation eliminates plants which take carbon out of the atmosphere as they grow/ref to less PS removing CO_2
4. Clearing land for other use
5. Replaced by crops which store less carbon/less wood.
6. Replaced by other animals/ cattle producing CO_2/ methane
7. Increased decay of vegetation.
8. Ref to oceans absorbing heat which slows/gives a lag of increasing CO_2 and increasing temps – will not have reached Max

Data usage – Section B

1. Significant increase in both CO_2 levels and temp since {approx. 1 850 - 1 900/ industrial revolution}
2. Ref to Temperature + year
3. Ref to CO_2 levels ppm + year
4. Currently at 408ppm / increase of approx. 25-31 ppm since 2000
5. Correlation between CO_2 levels ppm in atmosphere and global temperatures very close/ indicating {direct relationship/ link} between the two.
6. **human activities increasing CO_2** raising global temperatures.
7. Rising to highest level since 1 000 years ago.

Aquatic – Section C

1. Dissolving carbon dioxide in the ocean creates carbonic acid, which increases the acidity of the water.
2. Shells end up being thinner and more fragile.
3. Could be increased photosynthesis
4. Increased algal blooms with higher temperatures
5. Higher temperatures = lower O_2 in water – effect on fish
6. Migration of fish to cooler/warmer waters
7. Effect on fisheries/ fish
8. Coral reef destruction/coral bleaching/ loss of biodiversity

7-9 marks

Indicative content of this level is detailed content from all three areas

The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.

4-6 marks

Indicative content of this level is detail from two areas or some detail from three areas

The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.

1-3 marks

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Question 16 · A level Component 1 · June 2022 · Q7 · 9 marks

7				**Eutrophication** • {(Nitrate) fertiliser use / Animal waste / manure} {washed/ leached} into water • (Increased nutrient level in the water) increases algal {growth/ bloom}. • {Algae/ plants} die (due to lack of light) • Bacteria decompose {algae/ plants} • Respiration by decomposers cause oxygen levels fall/ ref to BOD. • {Fish/ invertebrates} die (due to lack of oxygen for respiration) **Deforestation** • Habitat destruction/ or description of • Reduction {biodiversity/ genetic diversity} • Extinction of species • CO_2 increase, {global warming/ climate change/ greenhouse} • Soil unstable / landslides / ref effect on soil **Resolved**. ▪ Sustainable farming techniques / or description/ less (nitrate) fertiliser (close to water courses)/ owtte ▪ Regeneration of forests / planting endemic species. ▪ Change to lifestyle e.g. encourage eating less meat/ Alternatives to palm oil ▪ National parks / SSSIs / encourage ecotourism as alternative source of income/ seed banks ▪ Change in government policy / public awareness/ education	4	3	2	9	
				7-9 marks Indicative content of this level is… Detailed description of all three sections. *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is… Detail from two sections or less detailed account of three sections *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is… Any correct indicative from any one area *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*					

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