

Markscheme

May 2019

Biology

Higher level

Paper 2

22 pages

No part of this product may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without written permission from the IB.

Additionally, the license tied with this product prohibits commercial use of any selected files or extracts from this product. Use by third parties, including but not limited to publishers, private teachers, tutoring or study services, preparatory schools, vendors operating curriculum mapping services or teacher resource digital platforms and app developers, is not permitted and is subject to the IB's prior written consent via a license. More information on how to request a license can be obtained from <http://www.ibo.org/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

Aucune partie de ce produit ne peut être reproduite sous quelque forme ni par quelque moyen que ce soit, électronique ou mécanique, y compris des systèmes de stockage et de récupération d'informations, sans l'autorisation écrite de l'IB.

De plus, la licence associée à ce produit interdit toute utilisation commerciale de tout fichier ou extrait sélectionné dans ce produit. L'utilisation par des tiers, y compris, sans toutefois s'y limiter, des éditeurs, des professeurs particuliers, des services de tutorat ou d'aide aux études, des établissements de préparation à l'enseignement supérieur, des fournisseurs de services de planification des programmes d'études, des gestionnaires de plateformes pédagogiques en ligne, et des développeurs d'applications, n'est pas autorisée et est soumise au consentement écrit préalable de l'IB par l'intermédiaire d'une licence. Pour plus d'informations sur la procédure à suivre pour demander une licence, rendez-vous à l'adresse <http://www.ibo.org/fr/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

No se podrá reproducir ninguna parte de este producto de ninguna forma ni por ningún medio electrónico o mecánico, incluidos los sistemas de almacenamiento y recuperación de información, sin que medie la autorización escrita del IB.

Además, la licencia vinculada a este producto prohíbe el uso con fines comerciales de todo archivo o fragmento seleccionado de este producto. El uso por parte de terceros —lo que incluye, a título enunciativo, editoriales, profesores particulares, servicios de apoyo académico o ayuda para el estudio, colegios preparatorios, desarrolladores de aplicaciones y entidades que presten servicios de planificación curricular u ofrezcan recursos para docentes mediante plataformas digitales— no está permitido y estará sujeto al otorgamiento previo de una licencia escrita por parte del IB. En este enlace encontrará más información sobre cómo solicitar una licencia: <http://www.ibo.org/es/contact-the-ib/media-inquiries/for-publishers/guidance-for-third-party-publishers-and-providers/how-to-apply-for-a-license>.

Extended response questions – quality mark

- ◆ Extended response questions for HLP2 each carry a mark total of **[16]**. Of these marks, **[15]** are awarded for content and **[1]** for the quality of the answer.
- ◆ **[1]** for quality is awarded when:
 - ◆ the candidate's answers are clear enough to be understood without re-reading.
 - ◆ the candidate has answered the question succinctly with little or no repetition or irrelevant material.

Section A

Question		Answers	Notes	Total
1.	a	week 34 AND 2014 ✓	<i>both needed</i>	1
1.	b	a. start of epidemic/first cases in rural areas OR epidemic spread to suburbs later ✓ b. higher maximum number of cases/greater increase in rural areas OR converse for suburbs ✓ c. increase came earlier in rural areas «than suburbs» OR number of cases peaked earlier in rural areas OR more cases in rural areas «than suburbs» in 2014 ✓ d. decrease came earlier in rural areas «than suburbs» OR decreasing in rural areas but not in suburbs in 2015/by end of study period OR more cases in suburbs than rural areas in 2015 ✓ e. «large» fluctuations in both ✓		3 max

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	c	<p>a. «overall decline due to» fewer cases in rural areas ✓</p> <p><i>Answers relating to people who died from the disease or develop immunity to it:</i></p> <p>b. fewer cases due to deaths of people who had the disease/people recovering OR more people vaccinated/became immune/made antibodies/were not vulnerable to infection ✓</p> <p><i>Answers relating to health care workers or availability of resources:</i></p> <p>c. more doctors/nurses/medical equipment/treatment centers/hospitals/spending/aid/NGOs ✓</p> <p><i>Answers relating to medical techniques used to tackle the epidemic:</i></p> <p>d. better treatments/infection control/hygiene/quarantine/new vaccine/new antiviral drugs ✓</p> <p><i>Answers relating to the public and patients:</i></p> <p>e. education/better awareness/avoidance of infection/taking precautions/vaccination accepted ✓</p> <p><i>Answers relating to reservoirs of infection:</i></p> <p>f. fewer infected people «who could spread infection»/fewer bats/less contact with bats ✓</p>		2 max

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	d	<p><i>differences:</i></p> <p>a. Conakry has more cases than any of the suburbs OR more cases in total in the suburbs than in Conakry ✓</p> <p>b. more male cases in Conakry whereas more female cases in suburbs ✓</p> <p>c. higher «% of» <u>fatal</u> cases at Ebola <u>treatment centers</u> in suburbs than in Conakry ✓</p> <p><i>similarity:</i></p> <p>d. in both Conakry and suburbs «% of» <u>fatal</u> cases in <u>treatment centers</u> is higher than outside ✓</p>		2 max

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	e	<p>a. most serious cases are in/are taken to treatment centers OR treatment centers are set up where there are most cases/most serious cases ✓</p> <p>b. long time/distance to travel between contracting disease and arrival at treatment center OR travel to treatment center weakens/upsets/harms the patient ✓</p> <p>c. Ebola is a virulent disease/Ebola virus mutated «to become virulent» OR little known about Ebola/new disease so treatments not yet developed ✓</p> <p>d. no/not enough vaccine/antiviral drug available «in 2014/15» OR antibiotics do not work against viral diseases ✓</p> <p>e. secondary infections/Ebola patients infected with other diseases/other Ebola strains OR ineffective hygiene/cleaning/sterilization/use of contaminated equipment/disposal of corpses ✓</p> <p>f. small number of staff relative to patients/treatment centers overcrowded/swamped with patients OR insufficient equipment/supplies for large number of patients/with the rapid rise in patients ✓</p> <p>g. better reporting at Ebola centers/deaths due to Ebola not reported in rural areas ✓</p>		3 max

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	f	a. cells not killed/few cells killed «even at high concentrations» ✓ b. «T-705» effective/viruses reduced/viruses killed at 100 µM OR «T-705» very effective/viruses much reduced/nearly all viruses killed at 1000 µM ✓ c. virus concentration decreases as T-705 concentration increases ✓ d. drug has «high» potential for treatment «at high enough concentration» ✓		2 max
1.	g	a. <u>vaccine</u> contains Ebola <u>antigens</u> ✓ b. vaccine «could» contain weakened/attenuated/dead/killed form of «Ebola» virus/virus genetically modified to express an Ebola/viral protein ✓ c. phagocyte/macrophage engulfs the antigen/presents the antigen to T cell ✓ d. antigen recognized by «specific» T cells/binds to T cells ✓ e. «activated» T cells activate «specific) B cells ✓ f. «activated» B cells make the <u>antibodies</u> «against Ebola» ✓ g. B cells divide forming «clone of» plasma cells/producing more B cells specific to Ebola ✓		3 max

(continued...)

(Question 1 continued)

Question		Answers	Notes	Total
1.	h	a. poor transport infrastructure/poor communication/bad roads/difficult access/no maps/support slow arriving/scattered population ✓ b. poor education/understanding of disease amongst health workers/local population OR continued contact with infected people / other example of unsafe actions ✓ c. more sources of infection such as bats/difficult to find sources of infection ✓ d. lack of/limited access to medical care/doctors/health care workers ✓ e. lack of/no access to/unaffordability of treatment centers/medical supplies/equipment/antivirals/drugs/vaccine/treatments ✓ f. refusal/reluctance in local population to be vaccinated OR difficult to find/reach everyone to vaccinate them/repeat the vaccination ✓ g. migration of people spreads the infection ✓ h. poor sanitation/lack of clean water ✓		2 max

Question		Answers	Notes	Total
2	a	<p>a. prokaryotes have circular DNA/chromosome but eukaryote chromosomes linear/OWTTE ✓ OR eukaryotes have telomeres/centromeres whereas prokaryotes do not ✓</p> <p>b. some prokaryotes have plasmids whereas eukaryotes do not ✓</p> <p>c. eukaryotes have multiple chromosomes whereas prokaryotes «typically» have only one ✓</p> <p>d. histones/nucleosomes/proteins associated with DNA in eukaryotes but not in prokaryotes/naked DNA in prokaryotes OR eukaryote DNA can coil/supercoil/condense «due to histones» but not prokaryote DNA ✓</p>		2 max
2.	b	<p>a. genetic disease/caused by a gene OR inherited «from parents» OR caused by mutation «of a gene» ✓</p> <p>b. base <u>substitution</u> OR GAG → GTG ✓</p> <p>c. hemoglobin gene mutated / different allele/form/version of hemoglobin gene OR Hb^A → Hb^S ✓</p> <p>d. leads to change in amino acid sequence «in hemoglobin» OR glutamic acid → valine ✓</p> <p>e. only homozygotes have full disease/sickled cells / heterozygote has milder form OR hemoglobin crystallizes at low oxygen concentration ✓</p> <p>f. «selected for/spreads in population» as it gives resistance to malaria ✓</p>		2 max

(continued...)

(Question 2 continued)

Question			Answers	Notes	Total		
2.	c	i	male because «X and» Y chromosome present OR male because sex chromosomes/last two chromosomes/pair 21 are unpaired/different «from each other»/not homologous ✓	<i>The answer must include “male” and the reason.</i>	1 max		
2.	c	ii	21		1		
2.	d	i	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; vertical-align: top;"> <p><i>Heterozygous offspring</i> «grey body, normal wings»</p> $\begin{array}{ c c } \hline b^+ & b \\ \hline vg^+ & vg \\ \hline \end{array}$ <p>OR $b^+b \ vg^+vg$</p> <p>OR $b^+vg^+ \ b \ vg \ \checkmark$</p> </td> <td style="width: 50%; vertical-align: top;"> <p><i>Homozygous recessive parent</i> «black body, vestigial wings»</p> $\begin{array}{ c c } \hline b & b \\ \hline vg & vg \\ \hline \end{array}$ <p>OR $bb \ vgvg$</p> <p>OR $bvg \ bvg \ \checkmark$</p> </td> </tr> </table>	<p><i>Heterozygous offspring</i> «grey body, normal wings»</p> $\begin{array}{ c c } \hline b^+ & b \\ \hline vg^+ & vg \\ \hline \end{array}$ <p>OR $b^+b \ vg^+vg$</p> <p>OR $b^+vg^+ \ b \ vg \ \checkmark$</p>	<p><i>Homozygous recessive parent</i> «black body, vestigial wings»</p> $\begin{array}{ c c } \hline b & b \\ \hline vg & vg \\ \hline \end{array}$ <p>OR $bb \ vgvg$</p> <p>OR $bvg \ bvg \ \checkmark$</p>		2
<p><i>Heterozygous offspring</i> «grey body, normal wings»</p> $\begin{array}{ c c } \hline b^+ & b \\ \hline vg^+ & vg \\ \hline \end{array}$ <p>OR $b^+b \ vg^+vg$</p> <p>OR $b^+vg^+ \ b \ vg \ \checkmark$</p>	<p><i>Homozygous recessive parent</i> «black body, vestigial wings»</p> $\begin{array}{ c c } \hline b & b \\ \hline vg & vg \\ \hline \end{array}$ <p>OR $bb \ vgvg$</p> <p>OR $bvg \ bvg \ \checkmark$</p>						

(continued...)

(Question 2 continued)

Question			Answers	Notes	Total
2.	d	ii	<p>a. not a 1:1:1:1 ratio «because of linkage» OR not independent assortment OR grey normal and black vestigial types/parental combinations/double dominant and double recessive were commoner than 25%/commoner than expected ✓</p> <p>b. «linked genes» so were on the same chromosome ✓</p> <p>c. grey body vestigial wing and black body normal wing are recombinants OR 2% plus 3% of the offspring are recombinants ✓</p> <p>d. recombinants due to crossing over/exchange of genes between «non-sister» chromatids OR 2% and 3% of offspring were due to crossing over OR genes inherited together unless separated by crossing over ✓</p> <p>e. crossing over between the two loci/between the two genes on the chromosomes ✓</p> <p>f. few recombinants/not much crossing over because genes/gene loci close together ✓</p>	<p>Accept any of these points from an annotated diagram.</p>	<p>2 max</p>

Question		Answers	Notes	Total
3.	a	<p><i>differences</i></p> <p>a. prokaryote has cell wall but mitochondrion does not ✓</p> <p>b. mitochondrion has double membrane whereas prokaryote has single membrane OR «Gram negative» bacteria have cell wall between two membranes whereas mitochondria has intermembrane space between two membranes ✓</p> <p>c. mitochondrion has cristae/invaginations of inner membrane but prokaryote does not OR prokaryote «may have» flagella/pili/«slime» capsule which mitochondria do not have ✓</p> <p><i>similarities</i></p> <p>d. <u>70S</u> ribosomes in both ✓</p> <p>e. <u>DNA</u> in both / loop of <u>DNA</u> in both / naked <u>DNA</u> in both ✓</p> <p>f. shape similar/both rod shaped/<i>OWTTE</i> OR size of both is similar/both about 3 µm long ✓</p> <p>g. both are membrane-bound/<i>OWTTE</i> ✓</p>		4 max

(continued...)

(Question 3 continued)

Question		Answers	Notes	Total
3.	b	a. endocytosis/engulfing of prokaryote by a larger/another/anaerobic prokaryote/cell ✓ b. double membrane of the mitochondrion is the result of endocytosis OR inner membrane of mitochondrion from engulfed cell and outer from food vacuole ✓ c. «engulfed prokaryotic cell» was aerobic/respired aerobically/consumed oxygen OR «engulfed prokaryotic cell» provided energy/ATP ✓ d. «engulfed prokaryotic cell» not destroyed/not digested OR «endo»symbiotic/mutualistic relationship developed ✓ e. «engulfed prokaryotic cell» had its own DNA/own «70S» ribosomes ✓	Do not award mpc for “mitochondrion makes ATP”.	2 max
4.	a	a. plasma membrane in phloem/sieve tubes but not in xylem/vessels OR xylem/vessels dead/acellular and phloem/sieve tubes alive ✓ b. xylem vessels have thicker walls «than phloem» ✓ c. xylem «vessel» walls are lignified «but phloem walls are not» ✓ d. phloem vessels have sieve plates «whereas xylem vessels have no cross walls» ✓ e. xylem/vessels are wider/larger than phloem/sieve tubes ✓ f. companion cells in phloem «but not in xylem» ✓		2 max

(continued...)

(Question 4 continued)

Question		Answers	Notes	Total
4.	b	a. water is polar/a dipole/oxygen slightly negative and hydrogen slightly positive ✓ b. polarity results in hydrogen bonds/attraction between water molecules ✓ c. hydrogen bonding/polarity causes cohesion of water «molecules» ✓ d. cohesion/hydrogen bonding allows water to withstand tension/withstand low pressure/be pulled «upwards»/moved against gravity ✓ e. cohesion/hydrogen bonding prevents column of water «in xylem» from breaking/column of water is maintained ✓ f. adhesion of water to xylem/vessel walls «due to hydrogen bonds» ✓		2 max
4.	c	a. chains of glucose/1-4 glycosidic linkages/covalent bonding between glucose ✓ b. beta glucose so alternating orientation of glucose units OR beta glucose forms straight chains ✓ c. forms microfibrils/long and thin/thin fibres/parallel bundles of cellulose molecules OR hydrogen bonding/cross linkage between cellulose molecules holds them together ✓ d. high tensile strength/rigid/doesn't stretch so provides support/allows turgidity ✓		2 max

Section B

Question		Answers	Notes	Total
5.	a	Outline the functions of rough endoplasmic reticulum and Golgi apparatus.		
		a. <u>ribosomes</u> on RER synthesize/produce polypeptides/proteins ✓ b. proteins from RER for secretion/export/use outside cell/for lysosomes ✓ c. Golgi alters/modifies proteins/example of modification ✓ d. <u>vesicles</u> budded off Golgi transport proteins «to plasma membrane» OR exocytosis/secretion of proteins in <u>vesicles</u> from the Golgi ✓	Accept "for use inside and outside the cell" for mpb.	3 max
5.	b	Outline the control of metabolism by end-product inhibition.		
		a. metabolism is chains/web of <u>enzyme</u> -catalyzed reactions OR metabolic pathway is a chain of <u>enzyme</u> -catalyzed reactions ✓ b. end product/inhibitor is final product of chain/pathway ✓ c. inhibits/binds to/blocks the first enzyme in chain/pathway ✓ d. non-competitive inhibition ✓ e. end-product/inhibitor binds to an allosteric site/site away from the active site ✓ f. changes the shape of the <u>active site</u> /affinity of the <u>active site</u> «for the substrate» ✓ g. prevents intermediates from building up OR prevents formation of excess «end» product/stops production when there is enough OR whole metabolic pathway can be switched off ✓ h. negative feedback ✓ i. binding of the end product/inhibitor is reversible OR pathway restarts if end product/inhibitor detaches/if end product concentration is low ✓ j. isoleucine inhibits/slows «activity of first enzyme in» threonine to isoleucine pathway ✓	Allow mark points shown in clearly annotated diagrams. To gain mpd, mpe and mpf the answer must be in the context of end-product inhibition, not enzyme inhibition generally.	5 max

Question		Answers	Notes	Total
5.	c	<p>Explain how hydrophobic and hydrophilic properties contribute to the arrangement of molecules in a membrane.</p> <p>a. hydrophilic is attracted to/soluble in water and hydrophobic not attracted/insoluble ✓</p> <p>b. hydrophilic phosphate/head and hydrophobic hydrocarbon/tail in <u>phospholipids</u> ✓</p> <p>c. <u>phospholipid bilayer</u> in water/in membranes ✓</p> <p>d. hydrophilic heads «of phospholipids» face outwards/are on surface ✓</p> <p>e. hydrophobic tails «of phospholipids» face inwards/are inside/are in core ✓</p> <p>f. cholesterol is «mainly» hydrophobic/amphipathic so is located among phospholipids/in hydrophobic region of membrane ✓</p> <p>g. some amino acids are hydrophilic and some are hydrophobic ✓</p> <p>h. hydrophobic «amino acids/regions of» proteins in phospholipid bilayer «core» ✓</p> <p>i. hydrophilic «amino acids/regions of» proteins are on the membrane surface ✓</p> <p>j. <u>integral proteins</u> are embedded in membranes due to hydrophobic properties/region OR <u>transmembrane</u> proteins have a hydrophobic middle region and hydrophilic ends ✓</p> <p>k. <u>peripheral proteins</u> on are on the membrane surface/among phosphate heads due to being «entirely» hydrophilic OR «carbohydrate» part of <u>glycoproteins</u> is hydrophilic so is outside the membrane ✓</p> <p>l. pore of <u>channel proteins</u> is hydrophilic ✓</p>	<p><i>Allow mark points shown in clearly annotated diagram.</i></p> <p><i>In any part of the answer, accept polar instead of hydrophilic and non-polar or apolar instead of hydrophobic.</i></p>	7 max

(Plus up to [1] for quality: The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.)

Question		Answers	Notes	Total
6.	a	Outline the process of inspiration in humans.		
		a. <u>diaphragm</u> and <u>external intercostal</u> muscles <u>contract</u> ✓ b. <u>diaphragm</u> moves down/becomes flatter OR <u>external intercostals</u> raise the ribcage/move the ribcage up/out ✓ c. muscles/diaphragm/intercostals increase volume of thorax/expand the thorax OR muscles/diaphragm/intercostals decrease pressure in the thorax ✓ d. as volume «of thorax/lungs» increases the pressure decreases ✓ e. air enters «lungs» due to decreased pressure/higher pressure outside body ✓ f. <u>air</u> flows to lungs through trachea and bronchi/bronchioles ✓	Accept thoracic cavity or chest cavity in place of thorax in any part of the answer. Do not allow "oxygen" instead of air in mpe or mpf.	4 max
6.	b	Describe the functions of valves in the mammalian heart.		
		a. prevents backflow/ensures one-way flow/controls direction of flow ✓ b. <u>open</u> valves allow blood to flow through OR opening and closing of valves controls timing of blood flow «during cardiac cycle» ✓ c. <u>closed</u> «semilunar» valves allow ventricles/chambers to fill with blood OR <u>closed</u> «semilunar» valves allow pressure in ventricles to rise «rapidly» ✓ d. valves open when <u>pressure</u> is higher upstream/OWTTE/converse for closed valves ✓ e. AV/bicuspid/tricuspid/mitral valves prevent backflow from ventricle to atrium OR AV/bicuspid/tricuspid/mitral valves open when pressure in atrium is higher «than in the ventricle»/when atrium is pumping/contracting ✓ f. semilunar/aortic/pulmonary valves prevent backflow from artery to ventricle OR semilunar/aortic/pulmonary valves open when pressure in ventricle is higher «than in the artery»/when ventricle is pumping/contracting ✓	Allow mpa, mpb, mpc or mpd if the point is made through the example of one specific valve.	4 max

(Question 6 continued)

Question		Answers	Notes	Total
6.	c	Explain how blood solute concentrations are kept within narrow limits in the human body.		
		a. solute concentration of blood monitored by the brain/hypothalamus ✓ b. pituitary gland secretes ADH ✓ c. ADH secreted when solute concentration/osmolarity is too high/a person is dehydrated/OWTTE ✓ d. collecting duct more permeable to water ✓ e. «more» <u>aquaporins</u> /opens <u>aquaporins</u> «in the plasma membrane of collecting duct cells» ✓ f. «more» water reabsorbed «into the medulla» ✓ g. medulla is hypertonic/hyperosmotic «so water can be reabsorbed from filtrate» ✓ h. small volume of urine/concentrated urine produced «with ADH» ✓ i. no/little/less ADH secreted if «blood» solute concentration is too low ✓ j. collecting duct less permeable to water/less water reabsorbed/large volume of urine produced/dilute urine produced «with low/no ADH» ✓ k. insulin causes blood glucose «concentration» to be reduced ✓ l. glucose stored as glycogen in the <u>liver</u> ✓ m. glucagon causes blood glucose «concentration» to be increased ✓ n. negative feedback ✓	Accept hypertonic for solute concentration too high and hypotonic for too low.	7 max

(Plus up to [1] for quality: The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.)

Question		Answers	Notes	Total
7.	a	<p>Outline the roles of helicase and ligase in DNA replication.</p> <p><i>helicase:</i></p> <ul style="list-style-type: none"> a. unwinds/uncoils the DNA «double helix» ✓ b. breaks hydrogen bonds «between bases» ✓ c. separates the «two» strands/unzips the DNA/creates replication fork ✓ <p><i>ligase:</i></p> <ul style="list-style-type: none"> d. seals nicks/forms a continuous «sugar-phosphate» backbone/strand ✓ e. makes sugar-phosphate bonds/covalent bonds between adjacent nucleotides ✓ f. after «RNA» primers are removed/where an «RNA» primer was replaced by DNA ✓ g. «helps to» join Okazaki fragments ✓ 		4 max

(continued...)

(Question 6 continued)

Question		Answers	Notes	Total
7.	b	Explain how natural selection can lead to speciation.		
		a. variation is required for natural selection/evolution/variation in <u>species/populations</u> ✓ b. mutation/meiosis/sexual reproduction is a source of variation ✓ c. competition/more offspring than the environment can support ✓ d. <u>adaptations</u> make individuals suited to their environment/way of life ✓ e. survival of better adapted «individuals)/survival of fittest/converse ✓ f. inheritance of traits/passing on genes of better adapted «individuals» OR reproduction/more reproduction of better adapted/fittest «individuals» ✓ g. speciation is formation of a new species/splitting of a species/one population becoming a separate species ✓ h. reproductive isolation of separated populations ✓ i. geographic isolation «of populations can lead to speciation» ✓ j. temporal/behavioral isolation «of populations can lead to speciation» ✓ k. disruptive selection/differences in selection «between populations can lead to speciation» ✓ l. gradual divergence of populations due to natural selection/due to differences in environment ✓ m. changes in the <u>gene pools</u> «of separated populations»/separation of <u>gene pools</u> ✓ n. interbreeding becomes impossible/no fertile offspring «so speciation has happened» ✓		7 max

(continued...)

(Question 7 continued)

Question		Answers	Notes	Total
7.	c	<p>Outline the features of ecosystems that make them sustainable.</p> <p>a. recycling of nutrients/elements/components/materials ✓</p> <p>b. carbon/nitrogen/another example of recycled nutrient/element ✓</p> <p>c. decomposers/saprotrophs break down organic matter/release «inorganic» nutrients ✓</p> <p>d. energy supplied by the sun OR energy cannot be recycled «so ongoing supply is needed» OR energy is lost from ecosystems as heat ✓</p> <p>e. <u>energy</u> flow along food chains/through food web/through trophic levels ✓</p> <p>f. photosynthesis/autotrophs make foods/trap energy OR autotrophs supply the food that supports primary consumers ✓</p> <p>g. <u>oxygen</u> «for aerobic respiration» released by autotrophs/photosynthesis/plants ✓</p> <p>h. <u>carbon dioxide</u> «for photosynthesis» released by respiration ✓</p> <p>i. populations limited by food supply/predator-prey/interactions/competition OR populations regulated by negative feedback OR fewer/less of each successive trophic level «along the food chain»/OWTTE ✓</p> <p>j. supplies of water from rainfall/precipitation/rivers/water cycle ✓</p>		4 max

(Plus up to [1] for quality: The candidate's answers are clear enough to be understood without re-reading. The candidate has answered the question succinctly with little or no repetition or irrelevant material.)