Mark Scheme (Results)

Summer 2018

Pearson Edexcel International Advanced Level
in Biology (WBI04)
The Natural Environment and Species Survival

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Summer 2018
Publications Code WBI04_01_1806_MS

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional guidance	Mark
1(a)(i)	photolysis (of water) ;	**ACCEPT** phonetic spellings e.g. photolisis **IGNORE** {light-dependent / light} reaction / photosynthesis **DO NOT ACCEPT** {light-independent / dark} reaction / hydrolysis	**(1)**

Question Number	Answer	Mark
1(a)(ii)	**D -** thylakoid *The only correct answer is D* ***A** is incorrect because photolysis takes place in the thylakoid* ***B** is incorrect because photolysis takes place in the thylakoid* ***C** is incorrect because photolysis takes place in the thylakoid*	**(1)**

Question Number	Answer	Mark
1(b)(i)	**D** – oxygen *The only correct answer is D* ***A** is incorrect because there are only 5 carbons in the ring structure* ***B** is incorrect because hydrogen is not in the ring structure* ***C** is incorrect because there is no nitrogen in glucose*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	1. {OH / hydroxyl} (group) is pointing down ; 2. on {carbon 1 / C1 / first carbon} ;	**1 ACCEPT** pointing up for β glucose **IGNORE** hydroxide **2 ACCEPT** anomeric carbon / the carbon on the right hand side (as the bottom line answer) **DO NOT ACCEPT** other carbon atoms	**(2)**

Question Number	Answer	Mark
1(b)(iii)	**B -** carbon dioxide only *The only correct answer is B* ***A** is incorrect because the O from ATP does not go into the glucose* ***C** is incorrect because the O in water does not go into the glucose* ***D** is incorrect because the O in water does not go into the glucose*	**(1)**

Question Number	Answer	Additional guidance	Mark
1(c)	1. contains {RUBISCO / RuBP} ; 2. site of Calvin cycle / eq ;	**1 ACCEPT** ribulose bisphosphate carboxylase / ribulose bisphosphate **2 ACCEPT** carbon fixation / synthesis of GP / synthesis of GALP / light-independent reaction / dark reaction	**(2)**

Question Number	Answer	Additional guidance	Mark
1(d)	1. (some) glucose {rearranged / eq} into fructose ; 2. joined by {glycosidic bonds / glycosidic links / condensation reaction} / eq ;	 **2 ALLOW** CE from mp 1 **IGNORE** numbering of bond	**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)	1. 6 out of 9 / ⅔ / two thirds / 66.67% / 66.7% / 67% / eq ; 2. because {six species are found only in Madagascar / the other (three) species are found in another country / eq} ;	**1 ACCEPT** 66.6 recurring % DO NOT ACCEPT 66.6% **2 ACCEPT** a clear definition of endemic e.g. a species that is only found in one country	**(2)**

Question Number	Answer	Additional guidance	Mark
2(b)(i)	1. idea that conditions (in Africa and Australia) are {similar / same / eq} ; 2. {similar / same/ eq} selection pressures ; 3. evolved from a common ancestor / eq ;	**1** e.g. climate / arid / hot / dry / soil type / environment / habitat / ecosystem **IGNORE** niche **3 ACCEPT** idea that they are genetically similar	**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)(ii)	1. because these two species (of tree) cannot produce fertile offspring / eq ;	**ACCEPT** reproductive isolation **DO NOT ACCEPT** geographical isolation **unless** clear that this leads to reproductive isolation **IGNORE** viable	**(1)**

Question Number	Answer	Additional guidance	Mark
2(c)	1. able to take up water when {plentiful / it rains / eq} ; 2. and store it for when {there is a shortage / it is the dry season / when the conditions become drier} ; 3. lose leaves when no water available for photosynthesis ; 4. {lose / do not have many / eq} leaves to reduce water loss / eq ;	**2 ACCEPT** store water for a long time **4 ACCEPT** do not have many leaves to reduce demand for water	**(2)**

Question Number	Answer	Additional guidance	Mark
2(d)(i)	1. description of a climate change; 2. idea of temperature change affecting {enzyme activity / metabolism} ; 3. idea that already adapted to cope with lack of water and cannot cope with even less ; 4. idea that {roots / seeds} would become water-logged if wetter ; 5. idea that change in conditions would affect competition ; 6. idea that there would be new {animal species so get eaten / pathogens} ; 7. idea that the number of tortoises changes and affects number of seeds {eaten / dispersed} ; 8. decrease in pollinators ; 9. increase in number of bush fires ;	**1** e.g. hotter / cooler / drier / wetter / desertification **4 ACCEPT** leaching of soil so not enough mineral ions for the trees	**(3)**

Question Number	Answer	Additional guidance	Mark
2(d)(ii)	1. change in number of tortoises; 2. habitat destruction / eq ; 3. disease (in trees / in tortoises) / eq ; 4. introduction of {new / more} herbivores / eq ; 5. introduction of new species of plant / eq ;	**2 ACCEPT** named example e.g. deforestation	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)	1. microorganisms secrete {enzymes / named enzyme} / eq ; 2. credit correct details of decomposition ; 3. idea that products of decomposition are {taken up into / used by} microorganisms ; 4. {glucose / hexose} used in respiration (by the microorganisms) ; 5. releasing {carbon dioxide / methane / eq} (into the atmosphere) ; 6. idea that other breakdown products return to the soil ;	**1 ACCEPT** bacteria / fungi throughout extracellular digestion **2** e.g carbohydrase breaks down glycogen, protein broken down into amino acids, **DO NOT ACCEPT** starch, cellulose, amylase, wrong detail	**(4)**

Question Number	Answer	Additional guidance	Mark
***3(b)**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea that decomposition occurs in a sequence of stages ; 2. idea that (during decomposition of animal or new plants) the condition of the soil will improve ; 3. idea that {more / different / longer } grass will start to grow ; 4. followed by trees ; 5. idea of {more / different} animals arriving ; 6. because {food / shelter / habitat} provided ; 7. greater biodiversity because increase in {species richness / (different) species} ;	**QWC emphasis on logical sequence** **1 ACCEPT** a description of some different stages of decomposition **3 IGNORE** references to colonisers / lichens / mosses / bushes / shrubs **4 ACCEPT** a comment about the tree in the photograph **IGNORE** other named larger plants **5 ACCEPT** idea of different insects in the cadaver **6 ACCEPT** the idea that the decomposing animal provides food **7 ACCEPT** increase in different types of {plant / animal / organism}	**(6)**

Question Number	Answer	Additional guidance	Mark
4(a)	1. idea that saliva contains an anticoagulant ; 2. by {inhibiting / binding to / eq} an enzyme ; 3. credit detail of the clotting process (that will not occur) ; 4. so a {mesh / network of fibres} is not formed / eq ; 5. idea that the blood will still be able to flow (into the mosquito) / eq ;	**1 ACCEPT** a chemical that prevents the clotting {cascade / process} **2 ACCEPT** blocks vitamin K binding calcium ions **IGNORE** production / release **4 IGNORE** scab / clot	**(4)**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	1. DNA {amplified / eq} using PCR ; 2. idea of fragments produced by restriction {enzymes / endonucleases} ; 3. credit details of gel electrophoresis ; 4. idea that the DNA of the woman has to be run ; 5. idea that the <u>bands</u> can be matched to those of the woman ;	**3** e.g DNA loaded onto agarose , application of a current , Southern Blotting	**(4)**

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	1. there will be mosquito DNA in the blood ; 2. idea of mosquito DNA bands and woman's DNA bands need to be compared ; 3. the mosquito DNA bands need to be eliminated / eq ; 4. idea that any other person's {blood / DNA} can be identified in addition to the woman's {blood / DNA} ;	**3 ACCEPT** only looking at the DNA of the woman / woman's DNA can be distinguished from the mosquito	**(2)**

Question Number	Answer	Additional guidance	Mark
5(a)	1. a {feeding / energy} level ; 2. in a food chain ;	1 **ACCEPT** stage **IGNORE** position 2 **ACCEPT** food web	(2)

Question Number	Answer	Additional guidance	Mark
5(b)	1. the higher the trophic level the smaller the predator : prey ratio / eq ; 2. change in trophic level has a greater {effect / decline / decrease} on the ratio in the marine environment / eq ; 3. predator : prey ratio in a marine environment is higher (at each trophic level) ; 4. there are fewer trophic levels in a food chain from a land environment / eq ;	**ACCEPT CONVERSE THROUGHOUT**	(3)

Question Number	Answer	Mark
5(c)(i)	**C –** net primary productivity *The only correct answer is C* ***A** is incorrect because biomass is not a measure of energy content* ***B** is incorrect because gross productivity is a measure of energy fixed before respiration* ***D** is incorrect because organic matter is the molecules present not their energy content*	**(1)**

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	1. (2 800 - 120 =) 2 680 ; 2. 95.71 / 95.7 / 96 / eq (%) ;	120 x 100 ÷ 2 800 = 4.29 100 - 4.29 = 95.71 / 95.7 / 96 **Correct answer with no working shown gains 2 marks**	**(2)**

Question Number	Answer	Additional guidance	Mark
5(c)(iii)	1. energy is lost between trophic levels / eq ; 2. idea that there will not be enough energy (to sustain another trophic level) ; 3. credit a reason for energy loss between trophic levels ;	**2 IGNORE** food	**(2)**

Question Number	Answer	Additional guidance	Mark
***6(a)(i)**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. interferons prevent viral replication ; 2. ribonuclease will break down viral RNA (of an RNA virus) ; 3. idea that ribonuclease will break down RNA that has been synthesised (from viral DNA / RNA) ; 4. protein kinase inhibits translation / (breakdown of RNA by) ribonuclease results in no translation ; 5. credit the name of a viral protein that would not be synthesised ; 6. idea that T killer cells will destroy (virus-infected) cells faster ; 7. less time for new virus particles to be produced / eq ; 8. idea that apoptosis releases incomplete virus particles / eq ; 9. idea that these {are engulfed by phagocytes / cannot go onto replicate} ;	**QWC emphasis is clarity of expression** **2 ACCEPT** (viral) mRNA **4 ACCEPT** protein kinase inhibits transcription (of viral DNA) **5** e.g. protein coat / capsid / capsomere / enzyme / named enzyme **6 ACCEPT** more T killer cells to destroy (virus-infected) cells **7 ACCEPT idea that as a result** fewer new cells will get infected **8 ACCEPT** idea that host cell is needed for viral replication	**(6)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	1. (host cell) RNA will break down (by ribonuclease) ; 2. {translation / protein synthesis} will be prevented (by ribonuclease / protein kinase) / eq ; 3. credit a named {protein / type of protein} that will not be made ; 4. credit a result of this protein not being made ;	**3** e.g. enzyme, channel proteins, histone, cytokine, hormone, antibody **4** e.g fewer metabolic reactions	**(3)**

Question Number	Answer	Additional guidance	Mark
6(b)	1. T killer cells {destroy / lyse / eq} virus-infected cells ; 2. by releasing {perforin / chemicals / enzymes} ; 3. macrophages {engulf / destroy / eq} virus particles ; 4. plasma cells produce antibodies ; 5. credit correct role of antibodies (in viral infections); 6. memory cells made to protect from future infections (by same virus) ;	**1 ACCEPT** cytotoxic / $CD8^+$ cells **2 ACCEPT** cytokines from T killer cells **IGNORE** cytokines from T helper cells **3 ACCEPT** neutrophils / eq **DO NOT ACCEPT** killed **4 DO NOT ACCEPT** B cells **5** e.g enhance phagocytosis / opsonisation / agglutination **DO NOT ACCEPT** destroy or kill **6 ACCEPT** memory cells for secondary immunity	**(4)**

Question Number	Answer	Additional guidance	Mark
7(a)(i)	1. credit suitable source of DNA ; 2. use PCR ; 3. credit details of conditions for PCR ; 4. credit named molecules needed ; 5. idea of many cycles ;	**1** e.g. bone, teeth, fur **3** e.g. sequence of temp changes, buffer **4** e.g. (DNA / TAQ) polymerase, primers, nucleotides **IGNORE** restriction enzymes / RNA polymerase	**(4)**

Question Number	Answer	Mark
7(a)(ii)	**B –** DNA ligase *The only correct answer is B* ***A** is incorrect because DNA helicase unwinds the DNA molecule* ***C** is incorrect because restriction enzymes cleave the DNA molecule* ***D** is incorrect because reverse transcriptase makes DNA from RNA*	**(1)**

Question Number	Answer	Additional guidance	Mark
7(a)(iii)	1. idea that the work has not been {validated / confirmed / repeating / eq} ; 2. by {the scientific community / peer review / other scientists} ;	**1 IGNORE** false / no proof / reliable / accurate / acceptable / valid	**(2)**

Question Number	Answer	Additional guidance	Mark
7(b)(i)	1. credit a reason relating to the mother elephant ; 2. credit a reason relating to the embryo ; 3. credit a reason relating to the baby elephant ; 4. credit a reason relating to cost ; 5. credit a reason relating to genetic modification ;	**1** e.g. mother could be harmed **2** e.g. destruction of spare embryos **3** e.g. baby not being accepted by other elephants **4** e.g. money could be better spent on {people / medicine / food / eq} **5** e.g. uncertainty of future consequences	**(2)**

Question Number	Answer	Additional guidance	Mark
7(b)(ii)	1. idea that these elephants with woolly coats can withstand cooler temperatures ; 2. and therefore could live in other (cooler) areas / eq ; 3. increasing availability of {food / water / space / eq} (for the elephants) ;		**(2)**

Question Number	Answer	Additional guidance	Mark
7(b)(iii)	1. idea that original habitat may no longer be protected ; 2. credit result of habitat no longer being protected ; 3. idea that more competition (between elephants / herbivores) for {food / space / water} (because less habitat / more elephants) ;	**2** e.g. habitat destroyed, animals poached, more grazing	**(2)**

Question Number	Answer	Mark
8(a)	**C** - glycogen *The only correct answer is C* ***A** is incorrect because amylose is present only in plants* ***B** is incorrect because glucose is soluble and is not a polysaccharide* ***D** is incorrect because starch is found only in plants*	**(1)**

Question Number	Answer	Mark
8(b)(i)		**(3)**

feature	virus only	bacterium only	virus and bacterium	not found in either a virus or a bacterium
contains both DNA and RNA	☐	☒	☐	☐
has cytoplasm	☐	☒	☐	☐
DNA may be single-stranded	☒	☐	☐	☐

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	1. idea of injecting the antigen ;	**1 ACCEPT** {attenuated / heat-destroyed} virus **DO NOT ACCEPT** killed / dead	**(3)**
	2. antigen engulfed by macrophage / eq ;		
	3. macrophage {presents antigen / is an APC} to T helper cells ;	**3 ACCEPT** B cells present antigen (to themselves)	
	4. T helper cells activate {B / T killer} cells ;	**4 ACCEPT** {(primary) immune response / humoral response / cell mediated response} initiated	
	5. formation of (B / T) memory cells ;		

Question Number	Answer	Additional guidance	Mark
8(c)	1. antibiotics used against (only) {bacteria / prokaryotic cells} ; 2. because antibiotics have target sites found only in bacteria / eq ;	**1 ACCEPT** do not target eukaryotic cells cancer cells are not {bacteria / prokaryotic cells} cancer is not caused by bacteria **IGNORE** cancer is caused by viruses **DO NOT ACCEPT** if clearly describing antibodies **2 ACCEPT** named target site e.g. cell wall **NB Antibiotics target bacterial cell walls = 2 marks**	**(2)**

Question Number	Answer	Additional guidance	Mark
8(d)	1. reference to an **evolutionary race** ; 2. idea that the number of bacteria resistant to antibiotics is increasing ; 3. credit reason for increase in resistance ; 4. idea that the use of antibiotics acts as a selection pressure ; 5. idea that bacteria reproduce {rapidly / asexually / eq} ; 6. idea that new antibiotics are not being developed (fast enough) ;	**2 DO NOT ACCEPT** immune **3** e.g. over-prescription , not finishing the course, prescribing for viral infections , prophylactic use, use in animal feeds	**(4)**

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