Mark Scheme (Results)

January 2017

Pearson Edexcel
International Advanced Subsidiary Level
in Biology (WBI04)
Paper 01 The Natural Environment and
Species Survival

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January 2017
Publications Code WBI04_01_1701_MS*

General Marking Guidance

- This mark scheme provides a list of acceptable answers for this paper. Candidates will receive credit for all correct responses but will be penalised if they give more than one answer where only one is required (e.g. putting an additional cross in a set of boxes). If a candidate produces more written answers than the required number (two instead of one, three instead of two etc), only the first answers will be accepted. Free responses are marked for the effective communication of the correct answer rather than for quality of language but it is possible that, on some occasions, the quality of English or poor presentation can impede communication and lose candidate marks. It is sometimes possible for a candidate to produce a written response that does not feature in the mark scheme but which is nevertheless correct. If this were to occur, an examiner would, of course, give full credit to that answer.
- 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)	**The only correct answer is C** **A** is not correct because the chloroplasts are in the cytoplasm **B** is not correct because the matrix is found in mitochondria not chloroplasts **D** is not correct because the tonoplast surrounds the vacuole	**C** stroma	(1) COMP

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	**The only correct answer is D** **A** is not correct because lysosomes are not found in chloroplasts **B** is not correct because the nucleolus is found in the nucleus, not the chloroplast **C** is not correct because the nucleus is found in the cytoplasm, not the chloroplast	**D** starch grain	(1) COMP

Question Number	Acceptable Answers	Additional Guidance	Mark
1(b)(i)	1. {fatty acids / tails} are {hydrophobic / non polar} ; 2. so move away from aqueous environment / eq ; 3. {phosphate group / heads} are {hydrophilic / polar} ;	**2 ACCEPT** turn away from water as our bottom line	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
1(b)(ii)	1. idea that {electron carriers / eq} pump the hydrogen ions into the {thylakoid / intermembranal} space ; 2. idea that {ATPase channels / eq} allow hydrogen ions to pass through (into stroma) ; 3. energy released from this movement (of hydrogen ions) / eq ; 4. that results in {phosphorylation of ADP / phosphate added to ADP / eq} ;	**1 DO NOT ACCEPT** into membrane **2 ACCEPT** synthase / synthetase **3 DO NOT ACCEPT** produced **4 NB** must be linked to context of mp 2 or 3 or {ATPase / eq}	(3) EXP

Question Number	Answer		Mark
1(b)(iii)	**The only correct answer is B** **A** is not correct because calcium is not found in chlorophyll; it is found in the cell wall **C** is not correct because nitrogen is covalently bonded in the porphyrin ring and not in its ionic form **D** is not correct because there is no phosphate group in chlorophyll	**B** magnesium	(1) COMP

Question Number	Acceptable Answers	Additional Guidance	Mark
1(b)(iv)	1. idea that this part is in the {membrane / phospholipid bilayer} ; 2. tail is hydrophobic / eq; 3. idea of holding chlorophyll in the correct {orientation / place / eq} ;	**1 ACCEPT** attached to	(2) EXP

Question Number	Answer	Additional Guidance	Mark
2(a)			

Feature	Bacteria and viruses	Bacteria only	Viruses only	Not found in either
Cytoplasm	☐	☒	☐	☐
Nucleic acids	☒	☐	☐	☐
Protein coat	☐	☐	☒	☐
Ribosomes	☐	☒	☐	☐

2(a)(i)

The only correct answer is 'Bacteria only'

Bacteria and viruses is not correct because viruses do not have cytoplasm

Viruses only is not correct because viruses do not have cytoplasm

Not found in either bacteria or viruses is not correct as bacteria have cytoplasm

2(a)(ii)

The only correct answer is 'Bacteria and viruses'

Bacteria only is not correct because viruses do have either DNA or RNA

Viruses only is not correct because bacteria do have both DNA and RNA

Not found in either bacteria or viruses is not correct as both bacteria and viruses have nucleic acid

	2(a)(iii) **The only correct answer is 'Viruses only'** **Bacteria and viruses** is not correct because bacteria do not have a protein coat **Bacteria only** is not correct because viruses do not have a protein coat whereas viruses do **Not found in either** bacteria or viruses is not correct as viruses have a protein coat **2(a)(iv**) **The only correct answer is 'Bacteria only'** **Bacteria and viruses** is not correct because viruses do not have ribosomes **Viruses only** is not correct because viruses do not have ribosomes **Not found in either** bacteria or viruses is not correct as bacteria have ribosomes		(4) Comp

Question Number	Acceptable Answers	Additional Guidance	Mark
2(b)	1. breathing problems / eq ; 2. blood in sputum / coughing up blood / eq ; 3. (TB causes) suppression of immune system / eq ; 4. credit other symptom that could result in death ;	**1 ACCEPT** shortness of breath **2** piece together IGNORE unqualified cough e.g. fever, organ failure, brain damage, (opportunistic) infection, pneumonia IGNORE diarrhoea, weight loss	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
2(c)	1. idea that HIV DNA (copy) becomes incorporated into the DNA (of the T helper cell) ; 2. (many) HIV particles are made / virus replicates} ; 3. idea that the T (helper) cell is {destroyed / lysed / eq} when the HIV leave the cell ;	1 **ACCEPT** provirus **DO NOT ACCEPT** RNA **3 ACCEPT** apoptosis / self-destruction **IGNORE** destroyed by T killer cells	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
2(d)	1. no indication of a correlation before 1990 / only indication of correlation after 1990 ; 2. the change in HIV is similar to the change in TB; 3. idea that changes in new cases of TB come after the changes in HIV ; 4. idea that there is no evidence in the graph that this is causation, so must be a correlation.	**2 DO NOT PIECE TOGETHER** **ACCEPT** the two curves are a similar shape / both go up	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
3(a)	1. to {produce / release / eq} antibodies ; 2. credit correct effect of antibodies ;	 **2 ACCEPT** eg enhance phagocytosis , opsonisation, 'labellling', they are antitoxins, agglutination	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
3(b)	idea that they can form many cell types ;	**ACCEPT only** blood cells **DO NOT ACCEPT** 'all cells types except {embryonic cells / embryonic-supporting cells / extra embryonic cells / totipotent cells}'	(1) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
***3(c)**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** Bleeding problems: 1. idea that fewer platelets affects clotting ; 2. idea that if blood does not clot then there will be bleeding problems; 3. idea that if blood clot does not form then pathogens can enter wound ; Infections: 4. idea of less {white blood cells / named WBC} to {destroy / phagocytose} pathogen ; 5. idea that a lack of T helper cells means that {T killer cells / B cells / humoral response / cell mediated / response} cannot be activated ; 6. idea that no T killer cells will result in host-infected cell not being destroyed ; 7. idea that lack of plasma cells will result in no antibody production ; Anaemia: 8. idea that lack of red blood cells means less oxygen ; 9. idea that less respiration results in less {ATP / energy} ;	**Emphasis is on logical sequence** **4 NB** if details given, they must be correct **7 DO NOT ACCEPT** idea that the B cells produce the antibody	(6) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
3(d)(i)	1. blood sample will have a lower number of {blood cells / platelets / white blood cells / red blood cells } ; 2. bone marrow sample will have {fewer stem cells / more plasma cells} ;	**NB** answers must have some indication of a comparison **1 ACCEPT** erythrocyte, T cells, T lymphocytes, B lymphocytes, B cells, plasma cells, monocytes, phagocytes, basophils, eosinophils, neutrophils **IGNORE** macrophages	(2) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
3(d)(ii)	1. idea that genetic tests can detect {gene / DNA / chromosome} {abnormalities / mutation} ; 2. idea that {myeloma / cancer} is caused by a mutation ; 3. in {genes that control rate of cell division / proto-oncogenes / tumour suppressor genes} ;	**1 ACCEPT** changes **ACCEPT** alleles **2 ACCEPT** changes in DNA / gene / allele **3 ACCEPT** formation of oncogenes	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
***4**	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea that {plants / organisms / peat / humus} are made up of organic matter ; 2. named example of organic matter ; 3. idea that if there is less decomposition less carbon dioxide will be released ; 4. by the respiration of {decomposers / bacteria / fungi / eq} ; 5. peatlands are carbon sinks ; 6. idea that this discovery has increased our knowledge of {peatlands / carbon cycle} ; 7. idea that carbon dioxide is used in {photosynthesis / light-dependent reaction / Calvin cycle / eq} ; 8. idea that (rate of) {photosynthesis / eq} depends on environmental factors ; 9. idea that information can be gained about the {carbon cycle / plant species / climate} (in the past) ; 10. example of analysis e.g. pollen, carbon dating ;	**Emphasis is on clarity of expression** **2** e.g. protein, cellulose, glucose **8 ACCEPT** named factor e.g. temperature **9 ACCEPT** temperature	(6) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(a)	1. competition for {space / nutrients / eq} (with bacteria / pathogen / microorganism / microbe) ; 2. production of anti-microbial chemicals / eq ;	**1 IGNORE** food **DO NOT ACCEPT** virus **2 ACCEPT** lactic acid / antibiotics / toxins **IGNORE** acid / pH **DO NOT ACCEPT** HCl	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(b)	1. idea that taking antibiotics {reduces the number of / kills / eq) gut flora ; 2. less competition with the *C. difficile* / *C. difficile* have more {space / nutrients} / eq;	**1 IGNORE** any numerical qualification	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(c)(i)	1. antibiotics act as a selection pressure ; 2. idea that when the antibiotic is being taken the resistant bacteria will {survive / reproduce / increase in number} ; 3. idea that when the antibiotic is not being taken the non-resistant bacteria will (also) survive ; 4. so there will be {more competition (with non-resistant bacteria) / less nutrients / less space} (for resistant bacteria) ;		(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(c)(ii)	1. idea that {the number of resistant *C. difficile* are increasing / new resistances are developing} ; 2. idea that new antibiotics {need developing / are being developed} ;	**1 DO NOT ACCEPT** immune **2 ACCEPT** idea that we need to increase our immunity to *C. difficile*	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(c)(iii)	1. only prescribing antibiotics for bacterial infections / not prescribing antibiotics for {minor (bacterial) / viral} infections ; 2. idea of prescribing an appropriate antibiotic ; 3. idea of prescribing correct dosage ; 4. idea of education of patients to follow instructions for taking antibiotics exactly ; 5. idea of reduction in the prophylactic use of antibiotics ;	**2** e.g. one that affects *C. difficile,* one that will kill the resistant bacteria **4** e.g. correct timing, finishing course	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
5(d)	1. idea that antibiotics affect gut flora in different ways / reference to bactericidal and bacteriostatic antibiotics ; 2. idea that bacteria affected by bacteriostatic antibiotics will recover faster ; 3. idea that bacteria affected by bacteriocidal antibiotics will recover more slowly ; 4. idea of length of time antibiotic remains in the body ;		(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
6(a)	1. reference to global warming / increase in mean global temperature ; 2. credit example of a cause; 3. credit correct details of global warming; 4. increasing the temperature of the earth's {surface / atmosphere} ;	**1 ACCEPT** average **2** e.g. burning of fossil fuels, deforestation **3** e.g. infrared radiation trapped, named greenhouse gas **DO NOT ACCEPT** incorrect gas **NB '**increasing the mean temperature of the earth's {surface / atmosphere}' gains both mp 1 and 4	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
6(b)(i)	1. increase in (total) number of species (with time) ; 2. increase in { species diversity / biodiversity / number of different types of species} (with time) ; 3. credit details of change in type of species ;	**NB** 'increase is species' gains one mark 'increase in number and types of species' gains mp 1 and 2 **3** e.g. trees are only found at T, tall shrubs appear at R	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
6(b)(ii)	1. reference to (primary) succession (between P and T) ; 2. {mosses / liverworts / lichens} as pioneer species ; 3. changing the rock into soil ; 4. idea that the soil improved (with time) ; 5. idea that more complex plants could grow ; 6. until climax community reached (at T) ;	**2 DO NOT ACCEPT** low shrubs and herbs **5 ACCEPT** named plant e.g. low shrubs **6 ACCEPT** T is a climax community	(4) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
6(b)(iii)	1. {three / more} (types of) species / appearance of tall shrubs ; 2. fewer {low shrubs / herbs} (species) ; 3. more {mosses / liverworts / lichens} (species) ; 4. credit manipulated figures to quantify mp 2 or 3 ; 5. idea of different species of animals present ;	**1 DO NOT ACCEPT** trees **4** e.g. 5 / 38% less low shrubs and herbs, 2 / 50% more mosses and liverworts and lichens	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
7(a)	1. (width =) 40 (mm) / 4 (cm) ; 2. = 800 mm / 80 cm / 0.8 m ;	Correct answer only with correct units = 2 marks Correct answer without units = 1 mark **1 ACCEPT** +/- 1 (mm) **2** If 39 mm given, width = 78 cm If 41 mm given, width = 82 cm	(2) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
7(b)	1. idea of {planting / using} several plants (of same species) ; 2. idea of planting (several) different species ; 3. idea of planting at different distances ; 4. idea of leaving plants to grow for a period of time ; 5. indication of measurement of growth (of these plants) ; 6. idea that the closest distance that plants {grow / are healthy / eq} is the closest distance that they can be planted ;	**1 ACCEPT** seeds **3 ACCEPT** idea of measuring distance that plants are growing from pre-existing bushes **5** e.g. germination, height, length	(4) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
7(c)(i)	Water availability: 1. credit method of sampling soil ; 2. credit description of how water availability is determined Light measurement: 3. idea of using light {meter / probe / eq} ; 4. held at {ground / plant} level ;	**1** e.g. taking a soil sample , pushing probe into the ground **2** e.g. heating the soil until dry and recording mass loss (ignore stated temperatures), using moisture meter	(4) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
7(c)(ii)	1. idea that water reduced because the (rhododendron) bush's roots have absorbed it ; 2. idea that light reduced due to shading (by rhododendron) ;		(2) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
8(a)(i)	avoid contamination (with DNA) / eq;	**NB** contamination with bacteria is not acceptable 'wear gloves' without correct reason is too vague **ACCEPT** idea of labelling samples	(1) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
8(a)(ii)	1. idea that PCR increases the number of copies of the DNA ; 2. for (gel) electrophoresis ;	**1 ACCEPT** 'amplifies DNA'	(2) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
8(b)(i)	1. idea of comparing bands; 2. idea that each bear has unique {DNA / banding patterns} ; 3. idea that the number of different banding patterns would equate to the number of different bears ;	**3 NB** 'more patterns means more bears' is too vague	(3) EXP

Question Number	Acceptable Answers	Additional Guidance	Mark
8(b)(ii)	not all (fur) samples collected / not all bears have left fur behind / presence of identical twin bears / bears may have died / bears may have moved out of the area / bears may be hibernating ;		(1) GRAD

Question Number	Acceptable Answers	Additional Guidance	Mark
8(c)	1. bear 3 ; 2. bands 2 and 3 had to come from father ;	**2 DO NOT ACCEPT** bands 1, 4 or 5	(2) GRAD

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