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Mark Scheme (Results)

January 2016

Pearson Edexcel International Advanced Level in Biology (WBI04) Paper 04 - The Natural Environment and Species Survival

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January 2016
Publications Code IA043014*

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)	A amino acid		**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	condensation / polymerisation (reaction)	**IGNORE** addition	**(1)**

Question Number	Answer	Additional guidance	Mark
1(a)(iii)	A NH_2 group and COOH group		**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(i)	C 2 and 4		**(1)**

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	C antibiotics kill or prevent the growth of bacteria		**(1)**

Question Number	Answer	Additional guidance	Mark
1(c)	1. ointment / cream / lotion / eq ; 2. can act fast / delivered in high quantities / not broken down in digestive tract / eq ;	**1. ACCEPT** topically **2. ACCEPT** localised / applied directly / produces few side effects / direct contact with bacteria / more effective / will not kill gut flora	**(2)**

Question Number	Answer	Additional guidance	Mark
1(d)	1. idea of using only when necessary ; 2. idea that patients should finish the course ; 3. idea of using narrow {spectrum / range} antibiotics ; 4. idea of not using just in case infection occurs ; 5. idea of using appropriate antibiotic (for the infection) ; 6. idea of rotating the antibiotics ;	**IGNORE** irrelevant suggestions **1. ACCEPT** not using for viral infections **3. DO NOT ACCEPT** use broad spectrum **4. ACCEPT** not using prophylactically	**(2)**

Question Number	Answer	Additional guidance	Mark
2(a)	(group of) (same) cells **AND** with {same / similar / specific / particular / common / eq} **AND** {structure / job / task / function / origin / eq} ;		**(1)**

Question Number	Answer	Additional guidance	Mark
2(b)	1. the gas exchange surface is the cell wall (and membrane) ; 2. so the diffusion distance is small (between air space and cytoplasm) ; 3. idea that the carbon dioxide can { continuously enter the leaf /circulate around the cells } ; 4. maintains a concentration gradient (between air space and cell) ; 5. idea that the (spongy mesophyll) cells are { irregularly shaped / loosely packed / have (air) spaces (between them) / eq } ; 6. large surface area (to volume ratio) ; 7. (air spaces / loosely packed) make diffusion {fast / eq} (through air spaces) ;	**N.B. 4 marks can only be awarded if at least one explanation (mp 2, 4, 6, 7, 9) is linked to an adaptation (mp 1, 3, 5, 8)** **3. ACCEPT** carbon dioxide used {by cells / for photosynthesis} **N.B.** stand alone mark, does not have to be linked to mp 5 **7. ACCEPT** diffusion easy **ACCEPT:** 8. (spongy / palisade mesophyll) cells are moist/ eq ; 9.(moisture) to dissolve the carbon dioxide / eq ;	**(4)**

Question Number	Answer	Additional guidance	Mark
2(c)	1. idea that carbon dioxide dissolves (in the moisture layer / cytoplasm) ; 2. idea that carbon dioxide { diffuses / moves / enters } into the { chloroplasts / stroma } ; 3. idea that carbon dioxide binds to RuBP / reference to carbon fixation / { reduction of carbon dioxide / eq } ; 4. reference to { Calvin cycle / light-independent reaction } ; 5. to produce GP / eq ;	**1. ACCEPT** carbon dioxide is soluble (in moisture) **3. ACCEPT** ribulose bisphosphate **5. ACCEPT** glycerate (3) phosphate	**(4)**

Question Number	Answer	Additional guidance	Mark
2(d)	1. water for photolysis / eq ; **Accept any TWO from :** 2. { phosphate / P_i / PO_4^{3-} } for ATP synthesis / eq ; 3. magnesium (ions) for chlorophyll ; 4. nitrate for { ATP / electron carrier protein / RUBISCO / ATP ase / enzymes involved in photosynthesis / chlorophyll / eq } ;	**NB** Use of formulae must be correct **1. ACCEPT** idea that water acts as a solvent for {carbon dioxide / enzymes / eq} **4. IGNORE** enzymes unqualified, proteins, amino acids	**(3)**

Question Number	Answer	Additional guidance	Mark
3(a)(i)	1. as a { comparison for the vitamin C results / control (group) / to ensure that it is vitamin C having the effect } ; 2. idea that it { determines / excludes / eq } psychological effects ;	**IGNORE** references to validity, reliability etc **1. ACCEPT** answers that refer to drug instead of vitamin C	**(2)**

Question Number	Answer	Additional guidance	Mark
3(a)(ii)	1. number of URTIs in each group : idea that vitamin C { increased (slightly) / had very little effect on } this ; 2. number of people who developed URTIs : idea that vitamin C { increased / had very little effect on } this ; 3. (mean) duration of the URTIs : idea that vitamin C reduced this ; 4. (mean) number of symptoms : idea that vitamin C reduced these ;	**Ignore references to effect of placebo throughout** **3. ACCEPT** decreased recovery time	**(3)**

Question Number	Answer	Additional guidance	Mark
3(a)(iii)	1. idea that it is unreliable as the sample size is not very large ; 2. idea that it is unreliable as there is no information about the people in the two groups ; 3. idea that the data for { duration / number of symptoms } is reliable as the mean is given ; 4. idea that { standard deviation / range / eq } has not been given for { duration / number of symptoms } so { unreliable / reliability is questionable / eq } ;	**2. ACCEPT** idea of no information given about control variables **4. ACCEPT** no statistical analysis of mean data so {unreliable / reliability is questionable / eq}	**(3)**

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. (improved chemotaxis) idea that phagocytes will be {able to move towards / attracted to / eq} the virus {sooner / quicker / eq} ; 2. (improved phagocytosis) idea that {phagocytosis faster / more effective} / more virus particles engulfed / eq ; 3. (improved killing mechanism) idea that virus particles {destroyed faster / more virus particles destroyed / eq} ; 4. (faster T helper cell division) idea that {B / T killer} cells {activated faster / eq} ; 5. (faster B cell division) idea that antibodies produced faster (by plasma cells) ; 6. (faster T killer cell division) idea that host-infected cells destroyed sooner ; 7. (increased interferon production) idea that fewer virus particles will be able to {attach to host cells / enter host cells / replicate / eq} ; 8. idea that when the host cell bursts the antibodies will bind to the virus particles and they will be destroyed faster;	emphasis on logical account **ACCEPT** more / sooner / faster throughout as appropriate **N.B.** A comparative statement is needed at least once within any one mark point **3. DO NOT ACCEPT** viruses are killed **5. ACCEPT** humoral response is faster **6. ACCEPT** cell mediated (CMI) response is faster **8. ACCEPT** opsonisation	**(6)**

Question Number	Answer	Additional guidance	Mark
4(a)	1. idea that the { smaller / 30:1 / eq } carbon : nitrogen ratio the faster the decomposition (up to 10 days) ; 2. idea that the { higher / 60:1 / eq } carbon : nitrogen ratio the decomposition { is slower / rises for longer / eq } ;		**(2)**

Question Number	Answer	Additional guidance	Mark
4(b)	1. increase in temperature due to release of heat (energy) / eq ; 2. from respiration ; 3. idea that at (high) temperatures enzymes denature ; 4. decrease in temperature due to { depletion of respiratory substrates / fewer decomposers / eq } ;	**2. ACCEPT** fermentation / metabolic reactions	**(3)**

Question Number	Answer	Additional guidance	Mark
4(c)(i)	1. nitrogen needed by {bacteria / fungi / microorganisms} ; 2. credit a correctly named nitrogen-containing compound ;	**1. IGNORE** decomposers	**(2)**

Question Number	Answer	Additional guidance	Mark
4(c)(ii)	1. idea that if the ratio is low the microorganisms: { will not have enough energy / cannot respire } **OR** have plenty of nitrogen for a named reason ; 2. idea that if the ratio is high the microorganisms: will not have enough nitrogen **OR** have plenty of carbon for respiration / eq ;	**1. ACCEPT** not enough carbohydrate / glucose / respiratory substrate	**(2)**

Question Number	Answer	Additional guidance	Mark
5(a)	1. habitat destroyed / eq ; 2. idea of (habitat destruction has resulted in) {lack of food / places to breed / eq} ; 3. idea that populations of panda have become {fragmented / isolated / separated / eq}; 4. idea that genetic diversity has become low ;	**1. IGNORE** cause eg global warming **IGNORE** poaching **4. ACCEPT** less gene flow	**(2)**

Question Number	Answer	Additional guidance	Mark
5(b)	1. idea that these pandas are **NOT** reproductively isolated ; **Any THREE from :** 2. idea that the two populations are geographically isolated ; 3. idea that {conditions / environments} (in the two areas) were different ; 4. reference to different selection pressures ; 5. reference to mutation in the {DNA / gene} causing a change in {phenotype / trait / eq } ; 6. idea that this phenotype had a survival advantage (to the pandas) ; 7. (resulting in) change in { allele frequency /gene pool / eq } ;	**1. ACCEPT** pandas can still breed (in a linked in appropriate context) **3. ACCEPT** a reasonable named condition	**(4)**

Question Number	Answer	Additional guidance	Mark
5(c)(i)	1. idea of extracting the DNA from the faeces ; 2. reference to (use of) {polymerase chain reaction / PCR} ; 3. to { amplify / increase the copies of / eq } DNA / eq ; 4. credit reference to the use of { restriction enzymes / eq } ; 5. to produce DNA fragments / eq ;	**1. IGNORE** any attempts to describe techniques within reason	**(4)**

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	1. idea of comparing the { (DNA) banding patterns / profile s} ; 2. number / width / position / eq (of bands) ; 3. idea that the number of different { sets of bands / profiles } will equal the number of pandas ;	**1. DO NOT ACCEPT** molecules / strands / fragments **3. ALLOW** number of different patterns will equal the number of pandas	**(3)**

Question Number	Answer	Additional guidance	Mark
6(a)(i)	1. elk decrease and wolves increase / eq ; 2. idea that elk decrease as they are { being killed / eaten / predated } by the wolves at a faster rate than they are reproducing ; 3. idea that the number of wolves increase as they are reproducing faster than they are dying ;	**1. N.B.** piece together **2. IGNORE** hunted **ACCEPT** elk are decreasing because {they are being killed / they are being eaten / they are predated /**lack of food through overgrazing }** / wolves are increasing because they are reproducing for 1 mark if neither mp 2 or 3 are awarded	**(3)**

Question Number	Answer	Additional guidance	Mark
6(a)(ii)	1. birth rate less than death rate / eq ; 2. idea that the elk population is too low provide enough food for the wolves ; 3. disease ; 4. idea that the wolves are being { shot / hunted } ; 5. movement of wolves out of the Park ;	**2. Accept** wolves will starve / competition for food	**(2)**

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. idea that there is less grazing (as there are fewer elk) ; 2. idea that (secondary) succession can now take place ; 3. resulting in a climax community ;	**2. Accept** a description of succession e.g. more plant <u>species</u>, increased biodiversity	**(3)**

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. idea that other animals (prey of wolves) might decrease in number ; 2. as they are also being {killed / eaten / predated} by the wolves / eq ; 3. idea that other {carnivores / predators of elk / eq } might decrease in number ; 4. as there are {fewer elk to eat / more competition for the elk} ; 5. idea that the {animals dependent on plants / herbivores / named examples e.g. birds , insects } may increase ; 6. credit correct (corresponding) reason ; 7. idea that { carrion feeders / named examples / eq} will increase ; 8. as there will be more dead animals / eq ;	**N.B. 4 marks can only be awarded if at least one explanation (mp 2, 4, 6, 8) is linked to a change in number of organisms (mp 1, 3, 5, 7)** **2. Ignore** hunted **6.** e.g. birds have more nesting places, more plants available for the other herbivores **N.B.** accept competition only if qualified	**(4)**

Question Number	Answer	Additional guidance	Mark
7(a)	D succession		**(1)**

Question Number	Answer	Additional guidance	Mark
7(b)	B forensic entomology		**(1)**

Question Number	Answer	Additional guidance	Mark
*7(c)	**(QWC - Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. idea of using the life cycle stage of the insects as these will change with time after death ; 2. idea of using the state of decomposition as the changes occur in a certain order / eq; 3. idea of using { ambient / environmental / eq } temperature as the rate of { insect development / decomposition / rigor / core temperature / eq } depends on temperature ; 4. because (core / ambient) temperature affects enzyme activity / eq ; 5. idea of using { core / body / eq } temperature as this changes with time after death ; 6. idea of using extent of rigor ; 7. idea of using the effect of { position / covering / size / eq } on body temperature; 8. idea of combining several pieces of information to arrive at estimate ;	**emphasis on clarity of expression** **5. ACCEPT** if core temperature is compared to a cooling curve **6. ACCEPT** a description if a change with time is indicated **7. N.B.** position would include exposure to wind / humidity	**(6)**

Question Number	Answer	Additional guidance	Mark
8(a)(i)	D to produce reliable data		**(1)**

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	Any **two** from: 1. { age / time of laying / batch } of eggs ; 2. { species / type } (of butterfly / caterpillar / egg) ; 3. temperature ; 4. water availability / humidity ;	**IGNORE** any other suggestions	**(2)**

Question Number	Answer	Additional guidance	Mark
8(a)(iii)	1. measure { length / mass / eq } of caterpillar ; 2. idea of measuring several caterpillars to calculate the mean (change in growth measurement) ; 3. idea of taking measurements over a period of time ; 4. growth rate = change in { length / mass } divided by time / eq ;	**1. DO NOT ACCEPT** dry mass, **Ignore** measurements taken of eggs **3. N.B.** need minimum of **two** measurements if times stated **4. ACCEPT** plot a graph of time against { length / mass } and determine the gradient of the line	**(4)**

Question Number	Answer	Additional guidance	Mark
8(a)(iv)	1. idea that different types of {food / cabbages} could have different composition of nutrients / eq } ; 2. idea different {carbohydrate / lipid / eq} content will provide different yields of energy ; 3. idea that {respiration / metabolism / production of ATP} is affected (by energy content / carbohydrate / lipid) ; 4. idea that the (ATP) energy used for {synthesis of new molecules / cell division} ; 5. idea that protein content will affect (rate of) {protein / enzyme / named example} synthesis ;	**1. ACCEPT** a different content of a named nutrient / energy	**(3)**

Question Number	Answer	Additional guidance	Mark
8(b)	1. (energy used) = 100 + 67 / 167 (J) 2. (energy available) = 200 - 167 / 33 (J) 3. = 16.5 (%)	Correct answer with no working shown gains full marks CE applies throughout **2. Accept** 200 - (100+67) **3. Accept** 17(%)	**(3)**

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