Mark Scheme (Results)

Summer 2015

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

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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		Mark
1(a)	1. carbon dioxide / CO_2 / methane / CH_4 ;	1 **DO NOT ACCEPT** carbon monoxide / CO **IGNORE** water	
	2. GP /GALP / glucose / hexose ;	2 **ACCEPT** glycerate (3) phosphate / PGA / glyceraldehyde (3) phosphate / triose phosphate / TP / $C_6H_{12}O_6$ **IGNORE** carbohydrates / monosaccharides / sugars	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)	1. idea that light results in { excitation / release / eq } of electrons from { chlorophyll / photosystems } ;	**1 ACCEPT** PSI / PSII	
	2. idea that this results in energy to { generate / eq } ATP ;	**2 ACCEPT** energy for photophosphorylation	
	3. reference to photolysis / idea that light is needed for { breakdown / eq } of water ;		
	4. electrons (from photolysis) replace electrons lost by { chlorophyll / photosystems } / eq ;		
	5. to produce { hydrogen ions / protons / H^+ } ;		
	6. idea that both ATP and {reduced NADP / hydrogen ions / eq } are needed in the {light-independent reaction / Calvin cycle (to convert GP to GALP)} ;	**6 NB** piece together	
	7. idea that { ATP / reduced NADP / hydrogen ions / eq } used in production of GALP from GP / eq ;		**(5)**

Question Number	Answer	Mark
1(c)(i)	**B** cellulose and starch	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	1. decomposition / idea of breakdown of { polysaccharides / cellulose / starch / organic matter / biomass / eq } ; 2. by { microorganisms / bacteria / fungi / eq } ; 3. by { hydrolysis / breaking } of glycosidic { bonds / eq } ; 4. by {enzymes / carbohydrases / named carbohydrase} ; 5. { monosaccharides / glucose / simple sugars } {respired / oxidised} releasing carbon dioxide / eq (plants / animals / bacteria / fungi) ; 6. idea that plants are burnt to release carbon dioxide ;	**NB** MPs can be accepted in the context of animals that have **eaten** the plants 1 **ACCEPT** decay / rot 2 **ACCEPT** saprophytes / saprotrophs / detritivores **NB** If mp 1 and 2 not awarded accept decomposers = 1 mark 5 **ACCEPT** anaerobic respiration of glucose releasing methane **DO NOT ACCEPT** carbon 6 **DO NOT ACCEPT** carbon	(4)

Question Number	Answer	Additional Guidance	Mark
2(a)	1. genetic material / nucleic acid / DNA or RNA ;	1 **DO NOT ACCEPT** DNA or RNA on their own	
	2. single-stranded or double-stranded (nucleic acid) ;		
	3. capsid / protein coat ;	3 **ACCEPT** capsomere **DO NOT ACCEPT** capsule unless correctly qualified	
	4. idea that an {envelope / eq} may be present ;	4 **DO NOT ACCEPT** capsule unless correctly qualified	
	5. idea of {spikes / attachment molecules / glycoproteins / eq} ;	5 **ACCEPT** receptor **DO NOT ACCEPT** gp120	
	6. some viruses contain {enzymes / reverse transcriptase / integrase} ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
2(b)(i)		**NB** do not award these MPs if there is any indication of latency, lysogeny, HIV, DNA incorporation into host DNA, integrase, reverse transcriptase, gp 120	
	1. idea of synthesis of (viral) {components / nucleic acid / DNA / RNA / proteins / enzymes} ;	**NB** If neither mp 1 nor 2 has been awarded, allow {replication of virus / new virus particles made } = 1 mark	
	2. idea of assembly of virus ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. idea that host cell destroyed ; 2. (lots of) virus particles are {released / eq} (at same time) ; 3. idea that more cells can be infected ;	**1 ACCEPT** host cell bursts	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(c)	1. idea that interferons inhibit viral replication ; 2. idea that interferon prevents { attachment / eq } of virus to (other host) cells ; 3. so that other cells cannot be infected (when they burst out of infected cell) ;	**3 ACCEPT** prevents entry of {virus / genetic material / eq}	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(d)		**NB** max 3 marks if only a description is given without some indication that time is needed hence the delay	
	1. {humoral / B cell / primary / eq } response / development of specific immunity / eq ;	**1 DO NOT ACCEPT** cell mediated immunity	
	2. idea that antigen has to attach to B cells ;	**2 ACCEPT** idea that B cells present antigen (to themselves)	
	3. idea that T (helper) cells are needed in activation of B cells;		
	4. idea that T (helper) cells have to {be activated / have macrophages present antigen to them / eq } (before they can activate B cells) ;		
	5. idea that {cloning / mitosis / division } of B cells has to take place ;		
	6. B cells {differentiate / specialise} into plasma cells ;		
	7. idea of antibody {production / secretion / eq} by plasma cells ;	**7 DO NOT ACCEPT** B cells	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	Archaea / Archaeobacter / Eukaryota / Eukarya ;	**ALLOW** phonetic spelling eg archae, eucarya **DO NOT ALLOW** eukaryote / archaeobacteria/ eubacteria / eubacter	**(1)**

Question Number	Answer	Mark
3(a)(ii)	**C** molecular phylogeny	**(1)**

Question Number	Answer	Mark
3(a)(iii)	**D** small (70S) ribosomes, loop of DNA	**(1)**

Question Number	Answer	Additional Guidance	Mark
3(a)(iv)	1. idea that there will be less light for photosynthesis ; 2. idea that fewer plants would mean { less food for / starvation of / death of / eq } { animals / named animal } ; 3. idea that bacteria involved in decomposition would reduce the oxygen levels ; 4. idea that there will be less oxygen (in water) for respiration for { animals / named animal } ;	**2 ACCEPT** idea that if less herbivores their predators will starve	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	1. fewer roach because they have been removed ; 2. fewer roach because <u>more being</u> eaten by the fish that were introduced ; 3. <u>fewer</u> zooplankton <u>will be</u> eaten (by the roach); 4. so zooplankton will { increase in number / reproduce } ; 5. fewer cyanobacteria as <u>more being</u> eaten (by the zooplankton) ;	**2 NB** fewer roach because more { fish / eq } is too vague **3 NB** fewer zooplankton because fewer roach is too vague **4 NB** more zooplankton is too vague **5 NB** fewer cyanobacteria because more zooplankton is too vague	**(4)**

Question Number	Answer	Mark
4(a)(i)	**A** one deoxyribose sugar and one phosphate group	**(1)**

Question Number	Answer	Mark
4(a)(ii)	**D** phosphodiester	**(1)**

Question Number	Answer	Mark
4(a)(iii)		**(3)**

Base	0%	17%	33%	34%
Adenine	⊠	⊠	[✗]	⊠
Cytosine	⊠	[✗]	⊠	⊠
Uracil	[✗]	⊠	⊠	⊠

Question Number	Answer	Additional Guidance	Mark

4(b)(i)	1. one correct calculation
	   eg (1.5 ÷ 1.4) = { 1.07 / 1.1 } x bigger
	      (1.5 ÷ 1.7) = { 0.88 / 0.9 } x bigger
	      (1.8 ÷ 1.4) = { 1.29 / 1.3 } x bigger
	      (1.8 ÷ 1.7) = { 1.06 / 1.1 } x bigger
	
	2. between { 1.06 and 1.29 / 1.1 and 1.3 } x bigger ;
		1 ACCEPT (average heights) 1.65 and 1.55 (m)
		
		2 ACCEPT 1.06 x bigger if alternative mp 1 awarded or no working is shown CE applies
			(2)

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	1. reference to natural selection ; 2. idea of mutation in {gene / DNA} coding for {lip shape / eq} ; 3. idea of mutation in {gene / DNA} coding for height ; 4. idea that change in lip shape resulted in better adaptation for feeding ; 5. idea that greater height of white rhinoceros protected it in the open ; 6. alleles (height / lip shape) passed onto offspring ; 7. idea of a change in allele frequency (in gene pool) ; 8. idea that the different food sources resulted in (different) selection pressures ; 9. credit appropriate reference to reproductive isolation ;	5 **ACCEPT** smaller black rhino is able to move amongst shrubs 6 **DO NOT ACCEPT** genes 9 **ACCEPT** correct examples of mechanisms e.g. different mating times, incompatible genitals	**(4)**

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	1. idea that they are eating different food / no competition for food ; 2. idea that they occupy different niches ;	1 **ACCEPT** less competition for food	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)(i)	1. reference to {bacteria / virus / pathogen / microorganism } ; 2. idea of being inside {tissues / cells / named tissue / named cell } OR idea of evading {barriers / named barrier eg skin } ;	1 **IGNORE** disease / infection / foreign matter 2 **IGNORE** body **IGNORE** {infects / attaches / harms / attacks} cells	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(a)(ii)	1. (gut flora) {prevent growth of / kill} {bacteria / pathogen / microorganism / eq}; 2. competition for {space / nutrients / named nutrient / attachment sites (to gut wall) } ; 3. release of {chemicals / anti-microbials / toxins / lipids / enzymes / substances / lactic acid } (by gut flora) / eq ;	1 **ACCEPT** prevent colonisation **IGNORE** antigens / viruses / infections / diseases 2 **IGNORE** food / resources 3 **DO NOT ACCEPT** lysozymes / HCl	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. {substance / chemical / molecule} produced by {microorganisms / fungi / bacteria} / eq ; 2. that {kills / inhibits the growth of} (other) {microorganisms / bacteria / pathogens / eq} ;	1 **ACCEPT** artificially produced **IGNORE** drug 2 **DO NOT ACCEPT** viruses	**(2)**

Question Number	Answer	Additional Guidance	Mark
*5(b)(ii)	QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence 1. credit a correct description of the immediate effect of taking antibiotics; 2. G is <u>resistant</u> to the antibiotics ; 3. all types, except G, are {susceptible / sensitive} to the antibiotics ; 4. G is the only type of bacteria (from 7 days) until 9 months ; 5. increase to 4 different types of bacteria at 12 months / eq ; 6. one new type of bacteria (J) at 12 months / eq ; 7. idea that the bacteria are in the diet ; 8. same (4) types of bacteria at 18 months ; 9. idea that G has the highest percentage at 18 months (compared to H, I and J) ; 10. because G can outcompete the others for {space / nutrients / eq}	**emphasis on clarity of expression** 1 ie they have compared the day 0 column to the day 7 column 2 **DO NOT ACCEPT** immune 4 **ACCEPT** in the first 9 months 5 **ACCEPT** 3 more types / H, I and J appeared 5 **DO NOT ACCEPT** reappear if includes J	**(6)**

Question Number	Answer	Mark
6(a)(i)	**D** succession	**(1)**

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	1. reference to succession ;	1 **IGNORE** primary / secondary	
		2 **ACCEPT** mud / lava / strong winds	
	2. idea of (large) decrease in number of plants because they are { being burnt / covered by ash / eq } ;		
	3. idea of soil improved ;		
	4. idea of {pioneer species / lichens / mosses / eq} growing first ;	5 **ACCEPT** small plants **DO NOT ACCEPT** trees / large plants	
	5. then {low-growing plants / ferns / small bushes / grass} ;		
	6. therefore increasing the number of {plants / (plant) species} ;		
	7. idea that the seeds of pre-existing plants {persisted / germinated / blown in / brought in by animals / eq } ;		**(4)**

Question Number	Answer	Additional Guidance	Mark
6(a)(iii)	1. idea that there will be {taller plants / bushes / trees / eq} ; 2. as the soil has become deeper ; 3. idea that taller plants outcompete the lower-growing plants / eq ; 4. reference to (co)dominant species (in the climax community); 5. idea there will be a similar number of **species** as before the eruption ; 6. credit a correct comment about the changes in animal species ;		(3)

Question Number	Answer	Additional Guidance	Mark
6(b)	**C** line Y is GPP, line Z is NPP, Q is R		(1)

Question Number	Answer	Additional Guidance	Mark
7(a)	1. membrane is fluid ;	1 **ACCEPT** phospholipids can move within membrane / is fluid mosaic **IGNORE** fluid mosaic model	
	2. (fluidity allows) membrane {can change shape / is flexible / be pushed out / eq };	2 **IGNORE** elastic / stretch /	
	3. (fluidity allows) membrane to {fuse / pinch off / eq} ;	3 **ACCEPT** cytokinesis	
	4. idea that proteins (in the membrane) play a role in cell transport ;	4 **ACCEPT** glycoprotein	**(3)**

Question Number	Answer	Additional Guidance	Mark
7(b)	1. DNA is {synthesised / eq} (in S phase) ;		
	2. idea that {mitosis / nuclear division} is needed to produce new nucleus (for the bud) ;	2 **ACCEPT** to produce two nuclei	
	3. idea that {DNA synthesis / mitosis / eq} means that the bud will have the same { genes / DNA / chromosomes / genetic material } / eq ;	3 **ACCEPT** the buds / daughter cells will be genetically identical	
	4. {cell division / cytokinesis} causes the bud to {form / separate / eq } ;	4 **IGNORE** budding	
	5. idea that cytoplasm has to increase ;		
	6. idea that there needs to be synthesis of {more organelles / named organelle / cell wall} (in interphase / G1);		**(4)**

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 a microscope to) count the number of yeast at start of investigation ; 2. idea of using a { range of / minimum of 5 } temperatures ; 3. in {water baths / incubators /eq } ; 4. idea that yeast are left for period of time (for budding to occur) / eq ; 5. idea of counting the number of {yeast / buds} at the end ; 6. idea of {repeats / replicates} to calculate a mean (number of yeast cells / rate) / eq ; 7. calculation of rate (of asexual reproduction) described ; 8. credit appropriate named control variable ;	**emphasis on logical sequence** 1 **ACCEPT** measuring turbidity 2 **ACCEPT** 5 quoted temperatures from 1°C to 70°C **IGNORE** room temp if 6 or more values given 4 **ACCEPT** any value above 5 minutes if stated 5 **ACCEPT** measuring turbidity 6 **ACCEPT** for reliability in correct context 8 **IGNORE** stated time	(5)

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	1. 800 + 600 / 1400 ; 2. (800 x 100 ÷ 1400) = 57 / 57.1 / 57.14 ;	2 CE applies if only one mistake made in mp 1 **NB** correct answer gains both marks	**(2)**

Question Number	Answer				Additional Guidance	Mark
8(a)(ii)	1. idea that greater { percentage / proportion } had HIV in 2008 ; 2. by correct calculated value (2010 – 2008) ;				1 CE applies from (a)(i) **ACCEPT** converse 2 CE applies from (a)(i) **ACCEPT** correctly rounded values	
	% calculated for 2010	**% calculated for 2008 (in part ai)**				
		57.00	**57.10**	**57.14**		
	23.80	33.20	33.30	33.34		
	23.81	33.19	33.29	33.33		
	24.00	33.00	33.10	33.14		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(a)(iii)	1. patients do not want to admit to having HIV / eq ; 2. idea that patients do not know that they are infected / eq ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
8(b)	1. idea that appropriate {antibiotics / named example} should be given to patients ; 2. idea of {educating patients about taking antibiotics / taking the full course of antibiotics ; 3. credit another appropriate procedure e.g. hand washing, screening ;	**1 ACCEPT** not giving antibiotics if not necessary / not using antibiotics for prophylactic treatment / using narrow spectrum antibiotics / rotate antibiotic use	**(2)**