Mark Scheme (Results)

Summer 2017

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)	**A -** electrons	hydrogen ions	oxygen atom **The only correct answer is A** *B is not correct because Q are ions not molecules and R is an atom not a molecule* *C is not correct because P are electrons, Q are hydrogen ions and R is an oxygen atom* *D is not correct because P are electrons, Q are hydrogen ions and R is an oxygen atom*	(1)

Question Number	Answer	Mark
1(b)	**C -** photolysis **The only correct answer is C** *A is not correct because water is split in the presence of light which is photolysis, condensation joins molecules* *B is not correct because water is split in the presence of light which is photolysis, hydrolysis uses water to split molecules* *D is not correct because water is split in the presence of light releasing electrons, reduction involves gaining electrons*	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)	1. for {photophosphorylation / phosphorylation of ADP} / eq ; 2. idea that electrons move along {electron carrier system / eq} ; 3. H⁺ accumulate in the thylakoid (space) / eq; 4. H⁺ release energy (for phosphorylation) as they move (into the stroma) through ATP synthase (channel) / eq ;	**3 Accept** idea that there is a proton gradient between the thylakoid space and the stroma	(3)

Question Number	Answer	Additional Guidance	Mark
1(d)	1. ATP and reduced NADP used in the conversion of GP into GALP / eq ; 2. ATP provides the energy for the conversion of GP into GALP ; 3. idea that the reduced NADP provides { hydrogen / reducing power / electrons / eq } ; 4. idea that ATP is used to regenerate RuBP ;	**Accept** NADPH throughout, TP for GALP **1 Piece together** **3 NB If a candidate scores mp 2 and 3 they will get 3 marks** **4 Accept** phosphorylation of RuBP	(3)

Question Number	Answer	Additional Guidance	Mark
2(a)	1. broken down by {enzymes / amylase / carbohydrases} (from microorganisms) ; 2. by hydrolysis (of glycosidic bonds) ; 3. idea that {bacteria / fungi / microorganisms} are involved ;	**1 Do not accept** cellulase **3 Ignore** decomposers	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)	 1. 780 − 180 / 600 ; 2. (600 ÷ 780 =) 76.92 / 76.9 / 77 (%) ;	**Correct answer with no working gains full marks** **2 ecf** if 900 − 180 is given and divided by 900 = 80 (%) **Ignore** + or - signs	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)	1. cellulose made of β glucose and starch is made of α glucose ; 2. cellulose has 1-4 glycosidic bonds and starch has 1-4 and 1-6 glycosidic bonds / eq ; 3. cellulose has alternating inverted glucoses but starch does not / eq ; 4. cellulose is a {straight / unbranched} chain (of glucoses) but starch has {amylopectin / branches} / eq ;	**Do not piece together**	(2)

Question Number	Answer	Additional Guidance	Mark
2(d)	1. for {strength / support} ; 2. for {waterproofing / impermeable to water / eq} ;		(2)

Question Number	Answer	Mark
3(a)		

Structure found in	Cell membrane	Mitochondrion	Small (70S) ribosome	Chloroplast
Both *Paramecium* and bacteria	☒			
Paramecium but **not** bacteria		☒		
Bacteria but **not** *Paramecium*			☒	

Bacteria are prokaryotes and *Paramecium* are eukaryotes therefore only a cell membrane is found in both cells, prokaryotes do not have mitochondria and eukaryotes have large (80S) ribosomes. Neither of these organisms contain chloroplasts

(3)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. *P.aurelia* start to increase in number sooner / eq ; 2. *P. aurelia* grow faster / eq ; 3. *P. aurelia* increase in number for a longer period of time / eq ; 4. *P. aurelia* produce {more / a greater increase in number of / eq } organisms ;	**NB All mark points must be comparative** **Accept converse throughout** **Ignore any references to time or number throughout** **3 Accept** *P. aurelia* plateaus later **4 Accept** more growth	(3)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	*P. aurelia* 1. lower numbers / slower rate ; *P. caudatum* 2. lower numbers / numbers were declining / eq ;	**1 Accept** numbers did not level off	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	1. idea that there are greater numbers of each species when cultured separately ; 2. competition between species for {bacteria / food} ; 3. idea that two species cannot coexist if they share the same niche ;	**1 Accept** converse numbers quoted for both species **2 Accept** *P. aurelia* outcompeted *P. caudatum* for {bacteria / food}	(3)

Question Number	Answer	Additional Guidance	Mark
4(a)	1. idea that cellulose molecules lie parallel with each other ;		
	2. cellulose molecules joined by hydrogen bonds (to form microfibrils) ;	**2 Ignore** microfibers / myofibres	
	3. idea that (layers of) microfibrils criss-cross with each other ;	**3 Accept** net-like structure / mesh	
	4. idea of a { matrix / pectin / pectate / hemicellulose } ;	**Do not accept** myofibres / microfibres	
	5. credit { secondary thickening / lignification / middle lamella } ;	**5 Accept** contain lignin / suberin	(3)

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	1. idea that the seaweeds occupy different (overlapping) regions up the seashore ; 2. idea that the {seaweeds found higher up the seashore / *F. spiralis*} have thicker cell walls ; 3. idea that {seaweeds higher up the shore / *F. spiralis*} {will be / can survive} out of the water for longer ; 4. idea that the thicker cell walls will help to {prevent dehydration / conserve water} ; 5. idea that competition exists between seaweeds ; 6. for {space / light / anchor points / eq} ;	NB Accept algae or plants throughout **1 Accept** zonation / description of range where all four species are found **2 Accept** converse / *F. serratus* further from the sea **3 Accept** converse / *F. serratus* **4 Accept** converse **Ignore** osmosis	(4)

Question Number	Answer	Additional Guidance	Mark
*4(b)(ii)	**QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence** 1. idea that the {two seashores / transects} should have similar {abiotic factors / (relevant) named abiotic factor } ; 2. reference to using a (belt / line) transect ; 3. idea that seaweeds are sampled at regular intervals (along the transect) ; 4. idea of {recording / counting / identifying / eq} which seaweeds are present; 5. credit an indication of how seaweed (abundance) is measured; 6. more than one {transect / eq} used ; 7. credit an indication of how results are {recorded / manipulated} ;	**QWC emphasis on clarity of expression** **1** e.g. substrate, incline, aspect **Accept** {abiotic factors / (relevant) named abiotic factor } measured **3 Accept** systematic sampling **5** e.g. using a quadrat, touching the transect, percentage cover, ACFOR scale **6 Ignore** repeat the investigation **7** e.g. graph of abundance against height of seashore, diagram similar to one in the question, indication of a calculation	(6)

Question Number	Answer	Additional Guidance	Mark
5(a)	**QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence**	**QWC emphasis on logical sequence**	
	1. idea that {components / named component } are host cell components ;	**1 Accept** e.g. amino acid	
	Proteins:		
	2. reference to translation (of viral RNA) ;		
	3. idea that RNA attaches to ribosomes ;	**3 Accept** mRNA	
	4. credit details of translation ;	**4** e.g. tRNA carries a specific amino acid / two tRNAs bind to the (viral) mRNA	
	5. peptide bonds form between (adjacent) amino acids ;		
	Poliovirus RNA:		
	6. idea that (RNA) nucleotides line up along the (poliovirus) RNA to make the template RNA ;	**NB** If no reference to a template strand is given for either mp 6 or 7, award 1 mark	
	7. idea that (RNA) nucleotides then line up along the template RNA in order to make the (poliovirus) RNA ;		
	8. credit details of how nucleotides join together ;	**8** e.g. formation of phosphodiester bonds / RNA polymerase	(6)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. (artificial) idea of human intervention ; 2. (active) stimulation of (primary) immune response / description of activation of lymphocyte involvement ; 3. (immunity) resulting in {memory cells / long-lasting protection / description of secondary immune response} ;	**1** e.g. injection of vaccine, given the {vaccine / antigen}	(3)

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. virus needs to be inactivated so that it cannot cause disease (polio) ; 2. idea that there are three different antigens; 3. so all three types of antibody have to be produced ; 4. (therefore) all three types of memory cells have to be produced ; 5. credit details of primary immune response that results in the production of memory cells ; 6. idea that the vaccine will result in (long term) immunity to all three strains ; 7. idea that a vaccine will result in antibodies being produced {quickly / in high numbers / eq} on infection with polio virus ;	**1 Allow** not infected **5** e.g. macrophages present antigen to T helper cells, activated B cells form B memory **7 Accept** idea that if all the antigens are not included in the vaccine a primary response would have to be stimulated and person would get sick	(4)

Question Number	Answer	Additional Guidance	Mark
6(a)	1. GM salmon will be longer and heavier ;	**Accept converse** **1 Piece together**	
	2. by {28 cm (longer) / 1.7 kg (heavier)} ;	**2** e.g. 1.8 × / 1.85 × / 84.8% (longer), 2.3 × / 130% (heavier)	(2)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)		**Correct answer with no working gains full marks**	
	1. 1300 - 100 / 1200 ;		
	2. 18 - 2 / 16 ;		
	3. (1200÷16 =) 75 **g month^{-1}** ;	**3** no ecf if both mp 1 and 2 are incorrect **NB** bald answer of {66.7 / 67} **g month^{-1}** **gains two marks**	(3)

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	Line drawn should start {at same point /above} the Atlantic salmon and end at 3000g at 18 months ;	**Do not accept** lines extrapolated back to zero **Do not accept** a line that reaches 3000 before 16 months	(1)

Question Number	Answer	Additional Guidance	Mark
6(b)(iii)	1. idea of {hatching the salmon from eggs / using newborn fish} ;		
	2. idea of using the same {conditions / named condition} as the other salmon were grown in ;	**2** e.g. temperature	
	3. idea of weighing the salmon at intervals (over this time period) ;	**3 Accept** subtracting mass at start from mass at end to calculate the increase	
	4. idea of using several salmon so that a mean can be calculated ;	**4 Ignore** repeating the investigation	(3)

Question Number	Answer	Mark
6(c)(i)	**B** gel electrophoresis **The only correct answer is B** *A is not correct because dendrochronology is the study of tree growth rings* *C is not correct because PCR amplifies the number of DNA molecules* *D is not correct because proteomics looks at proteins*	(1)

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	**Any two from :** different pattern of bands ; different position of bands ; different number of bands ; different {size / width / eq} of bands ;	**Ignore** fragments / blobs / DNA / strands	(2)

Question Number	Answer	Mark
7(a)(i)	**D -** virus-infected host cell **The only correct answer is D** *A* is not correct because B cells bind to antigen and present it to themselves *B* is not correct because plasma cells produce antibody *C* is not correct because T helper cells produce cytokines to activate the T killer cells	(1)

Question Number	Answer	Additional Guidance	Mark
7(a)(ii)	1. to increase the number of T killer cells ; 2. so that T killer cells { are antigen-specific /will only bind to (specific) infected host cells } ; 3. so that (host-)infected cells can be destroyed faster ;	**2 Accept** will only destroy (specific) infected host cell 　**Ignore** CD4 receptors **3 Accept** infected cells destroyed quickly / more infected cells destroyed	(2)

Question Number	Answer	Additional Guidance	Mark
7(a)(iii)	1. release of { chemicals / enzymes / perforins } (from T killer cells) ; 2. (enzymes cause the) lysis (of host-infected) cells / eq ;	**1 Do not accept** lysozymes	(2)

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	1. macrophages present antigen to T helper cells ; 2. credit detail of antigen presentation ; 3. idea that T helper cells are needed to activate T killer cells ;	**1 Accept** macrophages become APC to T helper cells **2** e.g. binding to CD4 antigen on T helper cells **3 Accept** T helper cells release cytokine to stimulate T killer cells	(2)

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. phagocytosis (of virus) / eq ; 2. (destruction of virus) with enzymes /eq ; 3. (enzymes breakdown) {protein coat / envelope / genetic material / eq} ;	**2 Do not accept** kill viruses Lysozyme **Ignore** interferons	(3)

Question Number	Answer		Additional Guidance	Mark
7(c)(i)			All correct = 2 marks ;; 1 correct = 1 mark ;	(2)

Parts of the cell	Line
Two poles of the cell	P
A chromosome and a pole	R
Two identical chromosomes	Q

Question Number	Answer	Mark
7(c)(ii)	**B** 15 minutes **The only correct answer is B** *A is not correct because there is no change in the distance between chromosomes and the poles* *C is not correct because the distance between chromosomes and the poles is already decreasing* *D is not correct because the distance between chromosomes and the poles has been decreasing for a while*	(1)

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	idea that they could be examined at a later stage ;	**Accept** to prevent decomposition / to keep evidence **Ignore** to kill bacteria	(1)

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	1. so that the {maggots / flies} could be identified / eq ; 2. (bear liver) used to provide (appropriate) food for the maggots / eq ;	**1 Accept** to determine the time it takes for the adult to develop **2 Accept** nutrients	(2)

Question Number	Answer	Additional Guidance	Mark
8(a)(iii)	21:00 (on 14th July) to 07:45 (on 15th July) ;		(1)

Question Number	Answer	Additional Guidance	Mark
8(a)(iv)	**Any one difference from:** time that the eggs were laid species of blow fly genotypes / genetic diversity / genetic make up / alleles metabolic rates development rate of egg temperature (ambient / each bear / body parts) length of life cycle ;	 **Do not accept** genes **Ignore** different conditions / environment	(1)

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	1. idea that time taken to hatch depends on {metabolic reactions / respiration / rate of development / eq };		
	2. increase in temperature increases rate of {enzyme activity / metabolic reactions } ;	**2 Accept** converse	

	3. credit detail of how an increase in temperature increases rate of enzyme activity ;	**3** e.g. more {collisions / energetic collisions / enzyme-substrate complexes formed} / increase in kinetic energy
		    Ignore denaturing
		    Accept converse
			(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	1. idea that the scientists did not know how dark it was before blow flies stop laying eggs ;		
	2. idea that the body temperature drops after death ;		
	3. idea that the ambient temperature changes (between time of death and when the scientists measured it) ;	**3 Accept ambient** temperature at time of death not known	
	4. idea that {there is a range of hatching times / do not know when the eggs were laid / there were different species of blow fly} ;		(2)

Question Number	Answer	Additional Guidance	Mark
8(c)	1. (idea that determining) time of death is influenced by a number of factors ; 2. gives a more accurate estimate of time of death / to narrow the time of death down / eq ;	**2 Accept** reliable, precise **Ignore** valid	(2)